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Two new species of *Gladiolus* (Iridaceae: Ixioideae) from South Africa and notes on long-proboscid fly pollination in the genus

J.C. MANNING*, P. GOLDBLATT** and P.J.D. WINTER***

Keywords: *Gladiolus rhodanthus, G. sekukuniensis*, Iridaceae, *Moegistorhynchus*, Nemestrinidae, new species, Northern Province, pollination, South Africa, taxonomy, Western Cape

ABSTRACT

Gladiolus **rhodanthus** is a new species known from a single population on the summit of the Stettynsberg near Villiersdorp in Western Cape, South Africa. The species most closely resembles *G. hirsutus* and *G. caryophyllaceus* but differs from both in flower shape and markings and in its ecology and reproductive biology. It forms part of a guild of long-tubed, pink-flowered species including *Erica praecox, Pelargonium radiatum* and *Watsonia paucifolia* which are pollinated by an undescribed long-proboscid fly, *Moegistorhynchus* sp. nov. (Diptera : Nemestrinidae). *Gladiolus* **sekukuniensis** is a new species known from three populations south of the Strydpoortberge in Northern Province. It closely resembles *G. permeabilis* subsp. *edulis* in vegetative features and in flower form, but differs from it in flower colour and in the elongate perianth tube. These floral features are apparently adaptations to pollination by long-proboscid flies.

INTRODUCTION

Arguably the largest genus in the family Iridaceae, *Gladiolus* contains some 260 species distributed throughout Africa and Eurasia as far east as Afghanistan, but its greatest centre of diversity is in southern Africa. Some 165 species occur in the subcontinent, of which 159 are endemic there (Goldblatt & Manning 1998). Within the subcontinent several centres of endemism have been identified (Goldblatt & Manning 1998). By far the greatest number of species occurs in the southwestern corner, the centre of the southern African winter rainfall region. This is an area of high topographic and edaphic diversity in which local endemism is highly developed. Many of these endemics are restricted to a single isolated massif or mountain range. It is not altogether surprising, therefore, that a new species of *Gladiolus* should be discovered on a high mountain barely four months after the publication of a comprehensive revision of the genus (Goldblatt & Manning 1998). A second centre of diversity, the Wolkberg centre, lies at the opposite end of the subcontinent in the highlands of Mpumalanga and Northern Province. This is a region of great geological complexity, and local endemism within the genus here is largely the consequence of the high edaphic diversity. Substrates favouring endemism include sandstones or quartzites, dolomite and serpentine. The discovery of another apparent edaphic endemic from the northern part of the region emphasises the importance of substrate in promoting speciation in *Gladiolus* throughout the subcontinent.

Species of *Gladiolus* are highly diverse in floral form and much of this variation is related to their pollination biology. Although bees are known or inferred to pollinate about 56% of the species in the genus (Goldblatt *et al.* 1998), one of the most important pollinators of the remainder are long-proboscid flies in the families Nemestrinidae and Tabanidae. This pollination strategy is uniquely well developed in southern Africa and numerous late spring- and summer-flowering plant species throughout the subcontinent have exploited it (Goldblatt & Manning in press). Southern African species of *Gladiolus* pollinated by long-proboscid flies typically have unscented, long-tubed cream or pink flowers marked on the lower tepals with red (Goldblatt & Manning 1998, 1999). The flowers of both species of *Gladiolus* described here conform exactly to this pattern and although pollination by long-proboscid flies has been confirmed in only one of the two species, it is inferred to occur in the second.

Gladiolus rhodanthus *J.C.Manning & Goldblatt*, sp. nov. Plantae 300–500 mm altae, cormo globoso 18–25 mm diametro tunicis fibris tenuibus verticalibus, foliis 3 pubescentibus, folio infimo basali lamina lineari 1.5–2.0 mm lata, costa incrassata marginibus vix incrassatis, caule eramoso, spica leviter flexuosa 2–5-flora, bracteis 26–45 mm longis, floribus atroroseis tepalis inferioribus stria albida hastiformi ornatis, tubo perianthii oblique infundibuliformi 25–36 mm longo, tepalis inaequalibus lanceolatis, tepalo dorsali 35–40 × 19–24 mm, inferioribus 27–30 × 11 mm, filamentis 15–17 mm longis, antheris 8–9 mm longis.

TYPE.—Western Cape, Villiersdorp Dist., summit of Stettynsberg, 12 Jan. 1999, *Manning & Paterson-Jones 2207* (NBG, holo.; K, MO, PRE).

Plants 300–500 mm high. Corm globose, 18–25 mm diam., tunics of medium-textured to fine vertical fibres, accumulating with age and forming a neck around base of stem. *Stem* erect, flexed outward above sheath of second leaf and inclined ± 30°, unbranched, 1–2 mm diam. below spike. *Cataphylls* pale and membranous, the uppermost dark green or purple above ground or sometimes dry. *Leaves* 3, lower one or two basal, the second of these

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sheathing lower half of stem, pubescent throughout, lowermost longest with blade reaching to between base and apex of spike, sometimes becoming dry at flowering time, the second with blade rather short and reaching upper third of stem, blades plane, more or less linear, 3–6 mm wide, midrib thickened and raised and a second pair of veins lightly thickened, margins scarcely thickened, the uppermost leaf inserted on upper third of stem, short, sheathing for half to two thirds of its length, blade vestigial, pubescent. *Spike* inclined, lightly flexuose, 2- to 5-flowered; bracts green or flushed brownish above, outer 26–45 mm long, acute, inner two thirds or rarely about as long as outer, lightly notched. *Flowers* deep pink, lower three tepals each with a spear-shaped whitish median streak in lower half edged in dark pink, especially in upper half, sometimes darker edging expanded transversely across entire width of upper laterals, throat white with a few dark pink streaks, unscented; perianth tube 25–36 mm long, cylindrical below for 20–28 mm, obliquely expanded in upper 5–7 mm, shortly exceeding bracts; tepals lanceolate, unequal, dorsal largest, inclined over stamens, 35–40 × 19–24 mm, upper laterals slightly shorter, 30–38 × 13–19 mm, recurved in upper half, lower three tepals joined to upper laterals for 5 mm and to one another for 1–2 mm, ± horizontal below, sharply flexed downward in middle, 27–30 × 12–13 mm, in profile lower tepals exceeding upper by 5–10 mm. *Filaments* 15–17 mm long, exserted 8–10 mm from tube; anthers 8–9 mm long, light mauve; pollen cream-coloured. *Ovary* oblong, ± 6 mm long; style arching over stamens, dividing at or slightly beyond apices of anthers, branches spreading, 5–7 mm long. *Capsules* ellipsoid, 20–22 × 8–9 mm. *Seeds* broadly and evenly winged, golden-brown, 5.5–7.0 × 4 mm. *Chromosome number*: unknown. *Flowering time*: late December to mid-January. Figure 1; Plate 1.

Distribution and biology: *Gladiolus rhodanthus* is known from a single large population on the Stettynsberg near Villiersdorp (Figure 2). The plants are restricted to broken sandstone cliffs on warm north-facing slopes at an altitude of 1 800 m where the corms are wedged in cracks in a peaty loam. Frequent summer cloud driven by strong southeasterly winds is a feature of many of the high mountains in the southwestern Cape. At this altitude and in this situation the soil around the corms of *G. rhodanthus* is still moist in the middle of summer when the plants flower.

The flowers of *Gladiolus rhodanthus* are pollinated by the fly, *Moegistorhynchus* sp. nov. (Nemestrinidae) which has a slender proboscis ± 20 mm long. There is a close fit between the shape of the flower and the body of the fly. The head and thorax of the fly fit snugly into the upper part of the tube when its proboscis is fully inserted into the lower part. In this position the dorsal thorax brushes against the anthers and style branches while it forages for nectar held in the lower third of the tube.

Several other plant species with long-tubed, similarly coloured flowers co-occur with *G. rhodanthus* and are also pollinated by this fly. They include *Erica praecox*, *Pelargonium radiatum* and *Watsonia paucifolia*. The convergence in flower colouring and perianth length between these plant species at this locality is a striking example of the effect that specialist pollinators can have on flower form. At the time of its description, the long-tubed flowers of *W. paucifolia* were contrasted with the funnel-shaped blooms of the closely related species *W. distans* which was thought to be pollinated by bees (Goldblatt 1989). It was already then recognised that the tubular flowers of *W. paucifolia* were probably specialised for pollination by a different agent, but no information on its pollination biology was available. The recent collection of the pollinator and associated guild members has vindicated this idea. More than one plant species which share a single long-proboscid fly as the pollinator often co-occur and converge in their floral morphology to form a local guild of species (Manning & Goldblatt 1996, 1997). Because of the potential dangers of interspecific pollen transfer in such guilds, pollen is invariably placed by different guild members on different parts of the pollinator's body. This is clearly demonstrated in the Stettynsberg guild: *G. rhodanthus* deposits pollen on the dorsal surface of the thorax, *W. paucifolia* on the top of the head, *E. praecox* on the face and *P. radiatum* on the underside of the thorax.

History: the species was apparently first encountered by botanists Ted and Inge Oliver in December 1997 on an expedition to collect a species of *Erica* high on the Stettynsberg to the north of Villiersdorp. Unfortunately no specimens were collected but the following year they revisited the locality accompanied by the natural history photographer, Colin Paterson-Jones, who collected a single plant. This specimen was quite unlike any known species of *Gladiolus* and another expedition was immediately organised in order to examine the plants in the field and to collect the type material. The Stettynsberg is one of the highest mountains in the greater Hottentots Holland chain, reaching just over 1 800 m at the summit, and until recently has not been accessible except by foot. The late flowering of *G. rhodanthus* is probably the reason that it was not seen by the indefatigable Cape botanist Elsie Esterhuysen, who first visited the mountain in 1948, and only a chance encounter with spent plants of *Erica schoemannii* in September 1998, prompted the Olivers to revisit the mountain in December.

Diagnosis and relationships: the three superposed leaves with hairy sheaths and hairy blades with a well-developed pair of secondary veins place *G. rhodanthus* in series *Linearifolius* of section *Linearifolius*. This series now contains 12 species, all restricted to sandstone-derived or granitic soils in the winter rainfall region. Radiation in the series is associated with extensive floral adaptation for specialised pollination strategies. In addition several species flower unusually late in the season during the summer, the dry season in most of Western Cape. Within the series the relationships of *G. rhodanthus* are less clear. Although most likely to be confused with the short-tubed and smaller-flowered *G. hirsutus* Jacq., the similarities between the two species are largely plesiomorphic and *G. rhodanthus* may be more closely allied to the species with an elongate perianth tube such as *G. caryophyllaceus* (Burm.f.) Poir. or *G. guthriei* F.Bolus.

Gladiolus rhodanthus is readily distinguished from the two other South African species of *Gladiolus* with well-developed hairy leaves and pink flowers, *G. hirsu-*

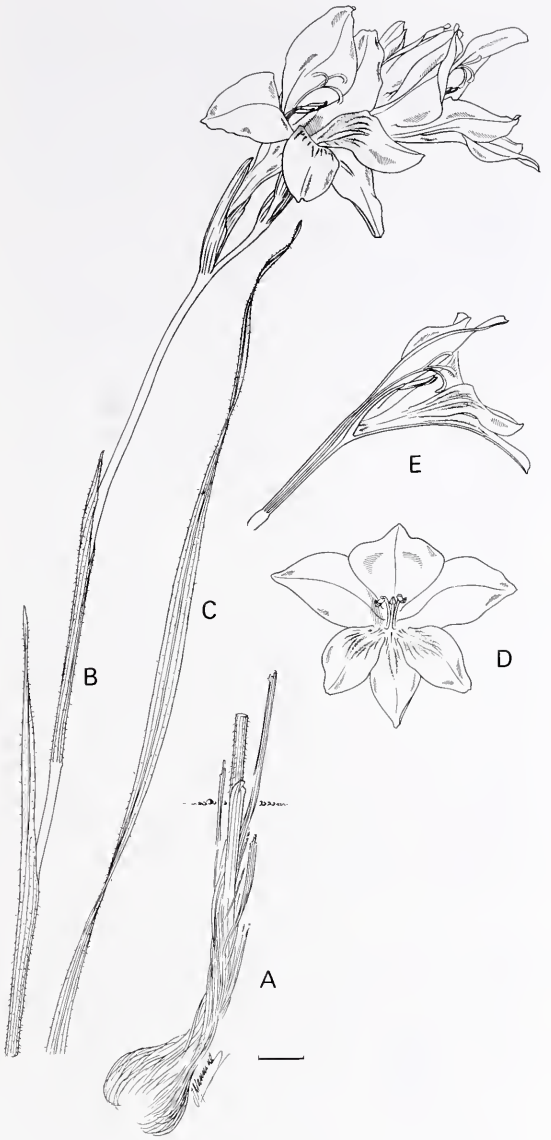

FIGURE 1.—*Gladiolus rhodanthus*. A, corm with cataphylls; B, flowering spike; C, leaf; D, flower, front view; E, half-flower. Scale bar: 10 mm. Artist: John Manning.

tus or *G. caryophyllaceus*, by the shape and markings of its flowers and by its late flowering time. Intermediate between these two species in size, the flowers of *G. rhodanthus* differ from both in their elongate perianth tube, 25–36 mm long, which is cylindrical for most of its length and flares only in the upper 5–7 mm, the lanceolate and acute tepals with plane margins and the median white lozenge-shaped marking outlined with red on each of the lower tepals. The flowers of *G. hirsutus* and *G. caryophyllaceus* are obliquely funnel-shaped and flared in the upper half, the tepals are ovate and obtuse, usually with undulate margins, and the lower tepals are irregularly streaked and spotted with red on a pale background. Although nearest *G. caryophyllaceus* in flower size, *G. rhodanthus* is also readily separated from this species by its unthickened leaf margins and shorter filaments, 15–17 mm long versus 22–27 mm long. It is most likely to be confused with *G. hirsutus* but this species has shorter bracts, 18–26 mm long versus 26–45 mm long, and shorter filaments, 11–13 mm long versus 15–17 mm long. In addition *G. rhodanthus* is distinct from these species in its habitat on broken cliffs at high altitude and late flowering time in December and January. *G. hirsutus* is a common species on stony granite or sandstone slopes and flowers mostly between July and September or rarely in March or April while *G. caryophyllaceus* favours dry habitats on open sandstone or granite slopes or in deep sands and flowers between August and September.

The marked floral differences between these species are linked to differences in their floral ecology. The funnel-shaped flowers of *G. hirsutus* and *G. caryophyllaceus* are typical of bee-pollinated species of *Gladiolus* and those of the former, at least, are visited by species of *Apis* and *Anthophora* (Hymenoptera: Apidae) (Goldblatt & Manning 1998; Goldblatt *et al.* 1998) whereas the more tubular flowers of *G. rhodanthus* are typical of species which are adapted to pollination by long-proboscid flies. In floral morphology *G. rhodanthus* is actually similar to another quite unrelated fly-pollinated species, *G. virgatus* Goldblatt & Manning (section *Homoglossum*). Shifts between pollinators among related species of *Gladiolus* are common and occur repeatedly throughout the genus. In this regard it is striking to note the floral similarity between both the bee-pollinated and long-proboscid fly-pollinated members of the species pairs *G. hirsutus–G. rhodanthus* (section *Linearioliius*) and *G. blommesteinii* L.Bolus–*G. virgatus* (section *Homoglossum*).

In a genus characterised by pollinator-driven floral diversity, series *Linearifolius* is particularly noteworthy for the frequency of derived pollination strategies (Goldblatt & Manning 1998). Out of the 12 species now recognised in the series only two or three are bee-pollinated, the plesiomorphic pollination strategy for the section and the genus. The remaining species have various derived pollination strategies including pollination by moths, long-proboscid flies, birds and the butterfly *Aeropetes tulbaghia* (L.). This strong shift to derived pollination strategies and, in many cases, late or aseasonal

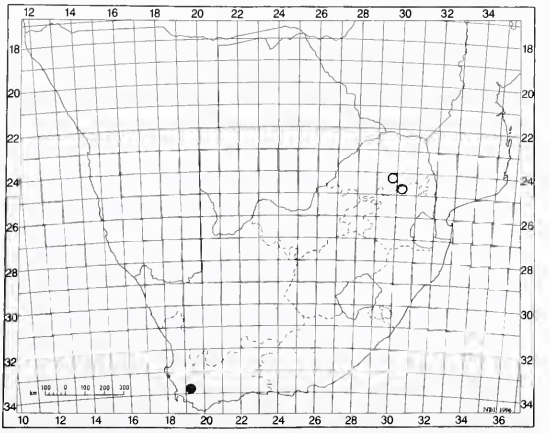

FIGURE 2.—Distribution of *Gladiolus rhodanthus*, ●; and *G. sekukuniensis*, ○, in South Africa.

flowering times, suggests that section *Linearifolius* entered the winter rainfall region relatively late in the history of the genus, at a time when most of the spring-flowering, bee-pollinated niches were already occupied by other species of *Gladiolus*, in particular those of sections *Hebea* and *Homoglossum* (Goldblatt & Manning 1998). Both of these sections have diversified strongly in the winter rainfall region, the former mainly on clay soils and the latter on sandstone-derived soils, and contain a preponderance of bee-pollinated species. The discovery of *G. rhodanthus*, another species in series *Linearifolius* which is both late-flowering and adapted to a specialised pollination strategy, provides further support for this hypothesis.

G. rhodanthus can be accommodated in the keys in the recent monograph, Gladiolus *in southern Africa* (Goldblatt & Manning 1998) by inserting the following couplet into both the key to section *Linearifolius* and the key to *Gladiolus* in the winter rainfall region of southern Africa, at leads 14′ (p. 53) and 33′ (p. 64) respectively.

14′/33′ Flowers shades of cream to pink or purple, the lower tepals streaked with dark red to purple; flowering mostly July to January, occasionally April to June

14a/33a Perianth tube cylindrical for most of its length and expanded only in the upper fifth; tepals lanceolate and acute, margins not undulate or crisped, lower tepals each with a white median spear-shaped marking outlined in red ..... *G. rhodanthus*

14a′/33a′ Perianth tube obliquely funnel-shaped, expanded in upper half; tepals ovate and obtuse, margins usually undulate or crisped, lower tepals irregularly marked with streaks and spots

Material examined

WESTERN CAPE.—3319 (Worcester): Villiersdorp Dist., summit of Stettynsberg, 12 Jan. 1999, (–CD), *Manning & Paterson-Jones 2207* (NBG, holo.; K, MO, PRE).

Gladiolus sekukuniensis *P.J.D.Winter*, sp. nov. Haec species *G. permeabili* subsp. *eduli* (Burch. ex Ker Gawl.) Oberm. similis quoad characteres vegetativos floralesque, sed 600–1 100 mm alta, floribus albis vel pallide carneis atrorubris in medio striatis inodoris, tubo perianthii 25–35 mm longo tepalum dorsalem excedente.

TYPE.—Northern Province, Sekukuniland, Leolo Mountain foothills, Farm Dsjate 249 KT, 800 m E of Motse River, 3 Apr. 1999, *P.J.D. Winter 3283* (NBG, holo.; K, MO, NBG, PRE, UNIN).

Plants 0.6–1.1 m high. *Corm* globose to conic, 8–15 mm diam., mostly producing cormlets on suckers to 100 mm long from base, suckers with scattered amplexicaul scales, tunics of fine-textured fibres. *Stem* erect, flexed outwards above sheath of fourth leaf, simple or with one or rarely more branches, 0.8–1.2 mm diam. below spike. *Cataphylls* pale and membranous, uppermost dark green or dry. *Leaves* usually 5–7, sometimes more, lower three to four basal, lower three usually reaching to at least base of spike or exceeding it; blades linear, (1–)2–4 mm wide, rigid, midrib thickened and raised, margins sometimes lightly thickened, cauline leaves shorter than basal, uppermost without a blade and sheathing for most of its length, lower margins free almost to base. *Spike* inclined, lightly flexuouse, 8–17-flowered; bracts cream-coloured or pale grey-green, flushed pinkish above, dry and pale near apices, the outer (14–)17–21 mm long, acute, the inner two thirds to almost as long as outer, acute or lightly notched. *Flowers* white or cream-coloured to pale salmon-pink, tepals each with a narrow, dark red, longitudinal median streak, often lacking or incomplete on dorsal tepal, lower tepals sometimes with yellow streak in centre, unscented; perianth tube (22–)25–35 mm long, cylindrical below for 20–30 mm, curved and weakly flared in upper 5–6 mm, much exceeding bracts; tepals unequal, all narrowed below into claws and more or less spade-shaped, attenuate and with twisted and undulate tail-like tips, dorsal largest, inclined over stamens, arching upward near apex, 25–35 × 8–11 mm, claw ± 5 mm, upper laterals directed forward, arching outward in upper half, 19–25 × 4.0–4.5 mm, claw ± 7 mm, windowed between bases of dorsal and upper lateral tepals, lower three tepals joined to upper laterals for 1.5–3.0 mm and to one another for 2.5–4.0 mm, with small thickened knobs at sinuses between lower tepals, free parts 15–18 × 1.5 mm, narrowed below into channelled claws 3–4 mm long, abruptly flexed downward into a narrowly lanceolate limb, in profile lower tepals exceeding upper. *Filaments* 10–12 mm long, exserted 6–8 mm from tube; anthers 5.0–6.5 mm long, dull blue; pollen cream-coloured. *Ovary* oblong, 3.5–4.5 mm long; style arching over stamens, dividing between middle and apices of anthers, branches, 1.5–2.0 mm long. *Capsules* ovoid-ellipsoid, 12 × 7 mm. *Seeds* ovate, 6.5 × 4.0 mm, translucent light brown, seed body dark brown, large in relation to the wing. *Chromosome number*: unknown. *Flowering time*: March to April. Figure 3.

Distribution and biology: *Gladiolus sekukuniensis* is known from two sites in Sekukuniland, west of the Transvaal Drakensberg (Figure 2). It grows in open woodland on the Strydpoortberge and nearby Leolo Mountains overlooking the upper Olifants River Valley. In both localities the species grows on alkaline soils. On the Strydpoortberge it occurs among *Acacia caffra* and *Combretum molle* on banded ironstone in soil containing lumps of calcrete associated with the surrounding dolomite, while on the Leolo range it occurs on norite with *Kirkia wilmsii* and *Catha transvaalensis* (another Sekukuniland endemic). Non-flowering plants are difficult to see among the tufts of *Themeda triandra* with which they are often associated. In form and colouring the flowers of *G. sekukuniensis* are highly reminiscent of those of *G. macneilii* Oberm. (section *Densiflorus*: series *Calcaratus*), a local edaphic endemic restricted to adjacent dolomite hills where the Olifants River cuts through the Transvaal Drakensberg. This species is known to be pollinated by the long-proboscid fly *Stenobasipteron wiedemannii* (Nemestrinidae) (Goldblatt & Manning 1998, 1999). The flowers of *G. sekukuniensis* conform to this pollination syndrome in morphology and flowering time and are apparently adapted to pollination by the same or another long-proboscid fly species. Several species of *Gladiolus* endemic to the Wolkberg centre of endemism in the highlands of Mpumalanga and Northern Province are adapted to pollination by long-proboscid flies in the family Nemestrinidae and these flies are clearly an important factor

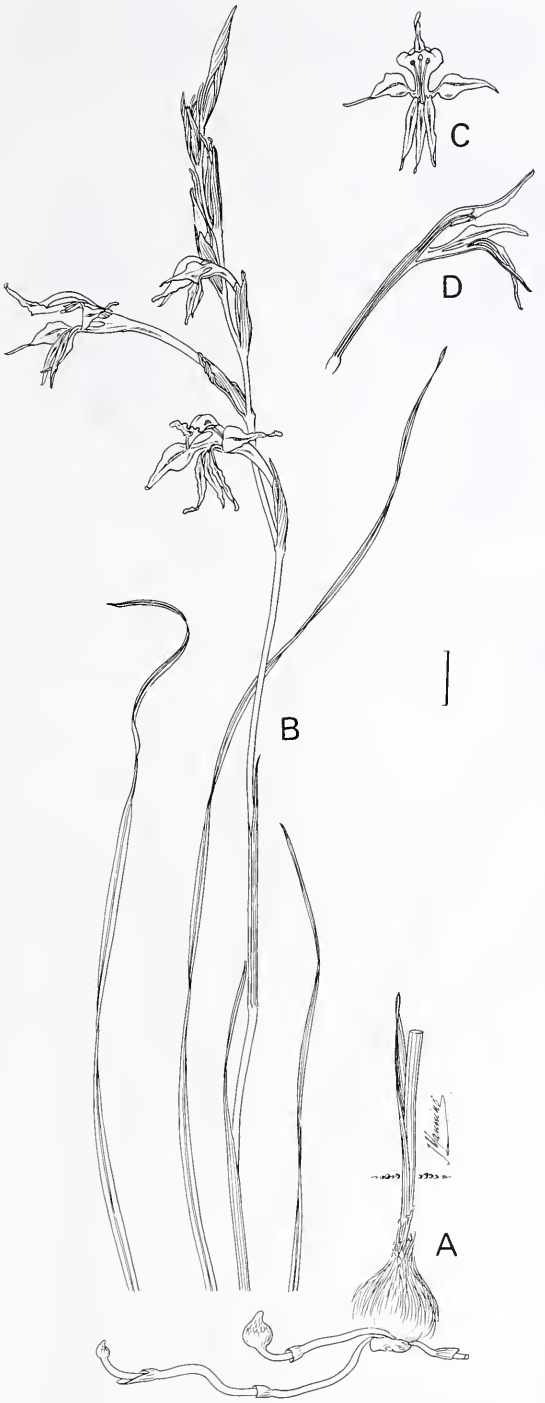

FIGURE 3.—*Gladiolus sekukuniensis* P.J.D.Winter. A, corm with cataphylls; B, flowering spike and leaves; C, flower, front view; D, half-flower. Scale bar: 10 mm. Artist: John Manning.

in the floral diversification of the genus there. The majority of these plants are grassland species which are visited by the fly *Prosoeca ganglbaurii*, but a few, including *G. macneilii*, *G. saxatilis* Goldblatt & J.C. Manning and *G. sekukuniensis* favour more wooded savanna or forest margin habitats and are probably all pollinated by *Stenobasipteron wiedemannii*.

History: first reported in 1997 from the Leolo Mountains by Sylvia Thompson of Haenertsburg, *Gladiolus sekukuniensis* was then collected from the Bewaarkloof area in the southern foothills of the Strydpoortberge in 1999, and subsequently from the population on the Leolo Mountains. Mervyn Lötter, a botanist with Mpumalanga Parks Board, has also reported the species from the same general area, bringing the number of known populations to three.

Diagnosis and relationships: the narrowly linear leaves without conspicuously thickened margins or evident secondary veins and the distinctively windowed flowers (in profile gaping between the dorsal and upper lateral tepals) with the tepal apices conspicuously tailed, indicate a very close relationship between *G. sekukuniensis* and *G. permeabilis* subsp. *edulis* (Burch. ex Ker Gawl.) Oberm. (section *Hebea*, series *Permeabilis*). Although widespread throughout southern Africa, *G. permeabilis* does not appear to have been recorded from Sekukuniland itself. It occurs on a variety of soil types, from deep Kalahari sands to fine-grained doleritic clays, but apparently not on dolomitic or other alkaline soils. The two species can be distinguished on details of flower colour and markings and in the length of the perianth tube. In addition, the suckers commonly produced from the base of the corm in *G. sekukuniensis* are unknown in *G. permeabilis*. The flowers of *G. permeabilis* subsp. *edulis* vary from a pale yellowish cream colour to dull purple, the lower tepals usually each with a narrow median yellow marking outlined with purple, and the perianth tube is obliquely funnel-shaped, shorter than the dorsal tepal and 9–15 mm long. The flowers of *G. sekukuniensis* are white or cream-coloured to pale salmon pink, each of the tepals with a median dark red streak, and the perianth tube is cylindrical, longer than the dorsal tepal and 22–35 mm long.

The species may also be confused with *G. macneilii* on account of the general resemblance in floral form between the two, but the flowers of *G. macneilii* are not windowed in profile because the tepals are not clawed, the upper lateral tepals are not marked, the perianth tube is rather longer, 40–45 mm long, and the anthers are distinctly tailed at the base.

G. sekukuniensis can be accommodated in the keys in the recent monograph Gladiolus *in southern Africa* (Goldblatt & Manning 1998) by inserting the following couplets into the key to section *Hebea* at lead 29 (p. 55) and into the key to *Gladiolus* in Botswana, northern Namibia, the northern provinces of South Africa and Swaziland at lead 21 (p. 59) respectively.

29 Perianth tube shorter than dorsal tepal, 9–15 mm long .... *G. permeabilis*

29′ Perianth tube longer than dorsal tepal, (22–)26–35 mm long

29a Perianth tube cylindrical; filaments 11–12 mm long; flowers cream-coloured to pale pink with dark red median streaks on all tepals; tepals with ribbon-like apices .... *G. sekukuniensis*

29a′ Perianth tube obliquely funnel-shaped; filaments 15 mm long; flowers mauve, lower tepals each with a yellow spear-shaped mark outlined with purple; tepals acute .. *G. uitenhagensis*

21 Perianth not windowed in profile; tepals obtuse to subacute; flowers white, without median streaks, sweetly clove-scented ..... *G. robertsoniae*

21 Perianth windowed in profile (gaping between dorsal and upper lateral tepals); tepals with ribbon-like apices; flowers cream-coloured or pale pink to mauve with dark median streaks or markings on lower or all tepals, unscented or sweetly scented

21a Perianth tube narrow and cylindrical, longer than dorsal tepal, 25–35 mm long ..... *G. sekukuniensis*

21a′ Perianth tube obliquely funnel-shaped, shorter than dorsal tepal, 9–15 mm long ..... *G. permeabilis*

Material examined

NORTHERN PROVINCE.—2429 (Zebediela): Bewaarkloof, Farm Hooggenoeg 293 KS, southeast shoulder of small plateau, 700 m south of Island Blue Waterfall, 1 200 m, 21 Mar. 1999, (–BB), *P.J.D. Winter 3232*. 2430 (Pilgrim's Rest): Steelpoort, Sekukuniland, Leolo Mountain foothills, Farm Dsjate 249 KT, 800 m east of Motse River, 1 000 m, 3 Apr. 1999, (–CA), *P.J.D. Winter 3283* (NBG, holo.; K, MO, NBG, PRE, UNIN).

ACKNOWLEDGEMENTS

Thanks to the Botha family of Stettyn for providing access to their property, to the Baragwanath and Thompson families for providing transport to field sites in Northern Province, and to Sylvia Thompson and Clare Bell for their assistance.

REFERENCES

GOLDBLATT, P. 1989. *The genus* Watsonia. National Botanic Gardens, Cape Town.

GOLDBLATT, P. & MANNING, J.C. 1998. Gladiolus *in southern Africa*. Fernwood Press, Cape Town.

GOLDBLATT, P. & MANNING, J.C. in press. The long-proboscid fly pollination system in *Gladiolus* (Iridaceae). *Annals of the Missouri Botanical Garden* 86.

GOLDBLATT, P. & MANNING, J.C. in press. Long-proboscid fly pollination in southern Africa. *Annals of the Missouri Botanical Garden*.

GOLDBLATT, P., MANNING, J.C. & BERNHARDT, P. 1998. Adaptive radiation of bee-pollinated *Gladiolus* species (Iridaceae) in southern Africa. *Annals of the Missouri Botanical Garden* 85: 492–517.

MANNING, J.C. & GOLDBLATT, P. 1996. The *Prosoeca peringueyi* (Diptera: Nemestrinidae) pollination guild in southern Africa: long-tongued flies and their tubular flowers. *Annals of the Missouri Botanical Garden* 83: 67–86.

MANNING, J.C. & GOLDBLATT, P. 1997. The *Moegistorhynchus longirostris* (Diptera: Nemestrinidae) pollination guild in southern Africa: long-tubed flowers and a specialised long-proboscid fly pollination system in southern Africa. *Plant Systematics and Evolution* 206: 51–69.

PLATE 1.—*Gladiolus rhodanthus* J.C.Manning & Goldblatt, × 0.9. Artist: Auriol Batten.


Aurol Batten

Bothalia 29,2: 225–230 (1999)

Studies in the Sphaerocarpales (Hepaticae) from southern Africa. 1. The genus *Monocarpus* and its only member, *M. sphaerocarpus*

S.M. PEROLD*

Keywords: Carrpaceae, Carrpineae, *Carrpos*, Hepaticae, Monocarpaceae, Monocarpineae, *Monocarpus sphaerocarpus*, southern Africa, Sphaerocarpales, Sphaerocarpineae, Sphaerocarpidae, Western Australia

ABSTRACT

A taxonomic account of the genus *Monocarpus* and its only species, *M. sphaerocarpus*, is presented. The species was initially discovered on salt pans in Western Australia, and only later, in southern Africa. It is extremely rare and the structure of the minute thalli is difficult to determine, also to describe and to illustrate. As far as could be determined, no SEM micrographs of the thalli and spores have been published before, nor has the capsule wall been illustrated.

INTRODUCTION

In my recent treatment of the Marchantiidae (Part 1: Marchantiopsida) for the *Flora of southern Africa* (Perold 1999), I excluded the Sphaerocarpales (subclass Sphaerocarpidae), as very little new material had been collected since the last investigations of its constituent genera, namely *Monocarpus* by Schelpe (1969), *Riella* by Wigglesworth (1937), and *Riella* and *Sphaerocarpos* by Proskauer (1955). Fortunately, a few new local collections of *Sphaerocarpos* and *Riella*, have recently come to hand. It is also deemed essential to publish SEM micrographs of the thalli and particularly the spores of these taxa, which has, with rare exceptions, not been done before.

MATERIAL AND METHODS

A few thalli of the only southern African gathering (to date) of *Monocarpus sphaerocarpus*, *Toelken 1586a*, were carefully removed from the substrate and washed with water gently squirted from a pipette to remove the soil particles. Remaining particles were manually removed by using fine-tipped forceps. One thallus was vertically sectioned into two halves, which were mounted in water on a slide, to examine the air spaces in the outer, protective tissues. Two other thalli were carefully slit open to remove the carpocephala and in one, the capsule was also excised. The barrel air pores and cells in the carpocephalum wall, as well as the cells in the capsule wall and the spores (mounted in Hoyer's medium) were studied and photographed under a compound light microscope.

The remaining portion of the cleaned specimen was fixed in FAA (formaldehyde/alcohol/ glacial acetic acid and distilled water in proportion of 2:1:1:20); dehydrated in an ascending series of acetone to 100% and critical point dried in a Balzers Union dryer, using liquid CO_2 as the transitional fluid. The thalli (and air dried spores) were mounted on aluminium stubs with double-sided sellotape, gold-coated, then viewed and photographed, using an ISI SX 25 scanning electron microscope.

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MS. received: 1999-05-20.

This plant is most interesting, but unfortunately I have had to 'make do' with scanty, 30-year-old material and was loath to sacrifice any more thalli than were absolutely necessary for my investigations.

Specimens examined

WESTERN CAPE.—3320 (Montagu): near Montagu, roadside, 300 yds from Baths Hotel, saline depression under *Suaeda fruticosa* (with *Tortula splachnoides*), (–CC), 6-10-1968. *H. Toelken 1586a* (BOL, MEL).

AUSTRALIA.—Far north-west Victoria, red ochre pits at NW edge of the Raak plain; on damp saline mud amongst halophytic shrubs, 1 Aug. 1968. *J.H. Willis* (*MELI28508, BOL58350*).

TAXONOMIC HISTORY AND AFFINITIES

The generic name, *Monocarpus* was selected by Carr (1956) for this unique Australian liverwort. He thought it advisable to raise a new suborder for it, Monocarpineae. To quote him: 'The affinities of this suborder would be with the Sphaerocarpineae on the one hand and with the section Caudiciformes of Marchantiineae on the other'. Later the generic name was changed to *Carrpos* by Proskauer (1961a), on the grounds that Post & Kuntze (1903) had created an orthographic variant, *Monocarpus*, for *Monocarpia* Miquel (1865), a genus in the Annonaceae. Proskauer argued that, 'if one *Monocarpus* is an orthographic variant of *Monocarpia*, another is also, whether based on the same type or not'. Bullock (1961) soon pointed out, however, that *Monocarpia* Miq. and *Monocarpus* D.J.Carr are not homonyms; also, that the correction of *Monocarpia* Miq. by Post & Kuntze to '*Monocarpus*' was not permissible and that this did not make *Monocarpus* a new and superfluous name.

Proskauer (1961b) concluded that phylogenetically, *Carrpos* did not represent an intermediate between the Sphaerocarpales and the Marchantiales, but rather an offshoot from a 'pre-*Riccia*' pool, well within the Marchantiales. He referred it to his new family, Carrpaceae. Originally, Grolle (1972) had adopted *Carrpos* and accepted the family Carrpaceae. Later, Grolle (1983) agreed that, under the Sydney ICBN, Article 63.1 (Voss *et al.* 1983), *Monocarpus* Post & Kuntze was an invalid

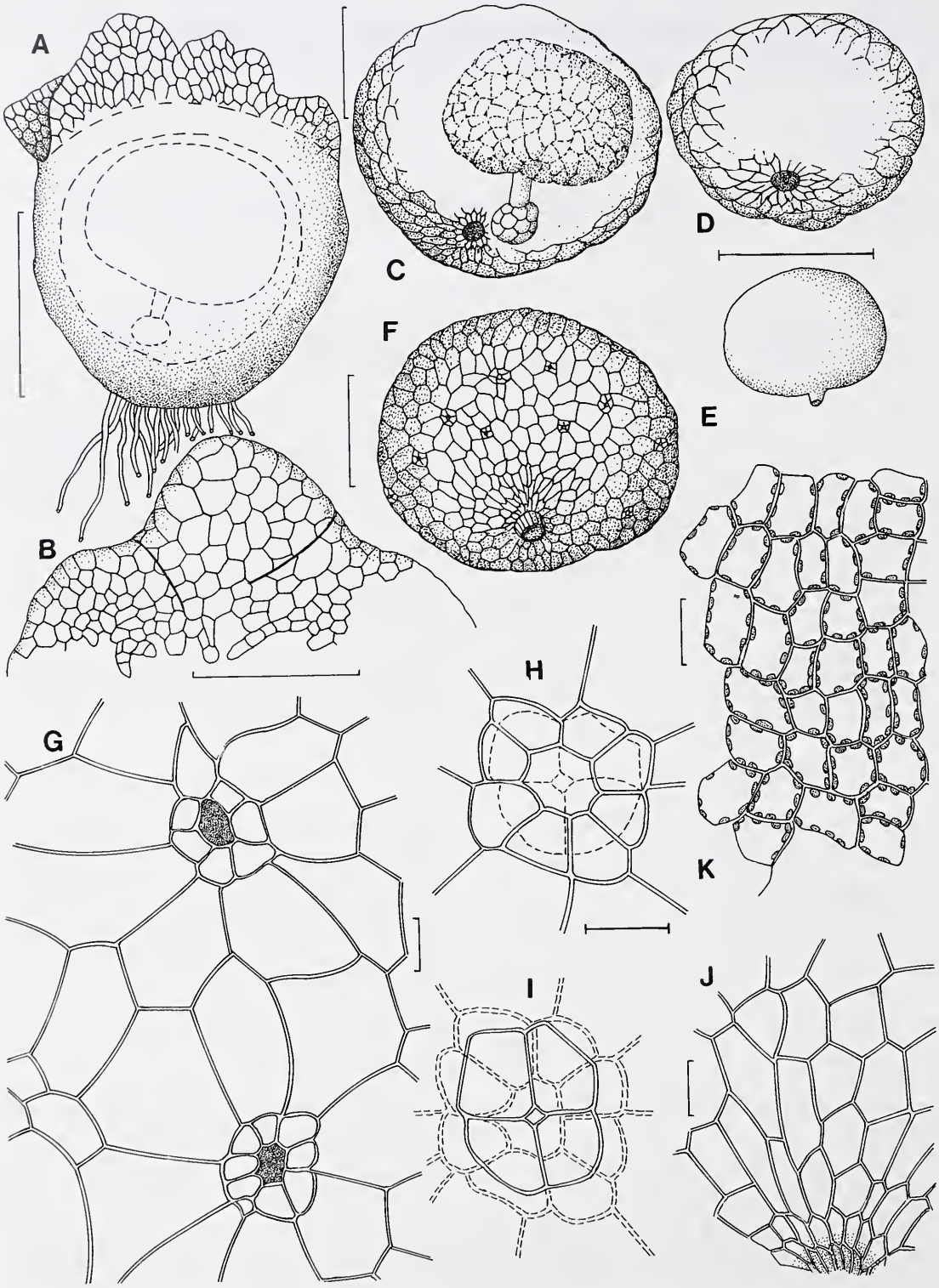

FIGURE 1.—*Monocarpus sphaerocarpus*. A, side view of thallus with bulging air chambers above and inside, capsule, seta and foot (stippled lines) enveloped by carpocephalum wall; B, above, domed air chambers separated by septa, below, cellular outgrowths from margin of pouch, arching over part of orifice; C, carpocephalum containing capsule with spores and below, short seta and bulbous foot; D, carpocephalum with capsule, seta and foot excised; E, excised capsule with part of seta; F, wall of carpocephalum with pores and part of stalk below; G, 2 air pores in wall of carpocephalum; H, pore from above; I, pore from below; J, cells in wall of carpocephalum decreasing in size toward stalk, the latter only partly shown; K, capsule wall with thickenings. A–K, *Toelken 1586a*. Scale bars: A, B, 1mm; C, F, 500 µm; D, E, 800 µm; G–J, 25 µm; K, 50 µm. Artist: G. Condy.

orthographic variant of the legitimate *Monocarpia* Miq. Hence, *Monocarpus* D.J.Carr was legitimate and *Carrpos* Prosk. was superfluous.

The generic name *Carrpos* continued, however, to be in use for some time to come. Schelpe (1969), in recording the only southern African find of this rare species [*Toelken 1586a* (BOL, MEL)], referred to it as *Carrpos sphaerocarpos* (D.J.Carr) Prosk. Because, according to Schelpe, Carr did not validate his proposed family, Monocarpaceae, Schelpe proceeded to do so, evidently unaware of Proskauer's Carrpaceae (Proskauer 1961b). He also thought that its taxonomic position appeared to be intermediate between the Sphaerocarpales and the Marchantiales, and he was 'disinclined to follow Carr in placing this family in the Marchantiales', preferring to 'wait for the discovery of male gametophytes'. He clearly did not know that Proskauer (1961b) had shown the species to be monoicous, with antheridia hidden in the air chambers of the thallus and difficult to find.

In Magill & Schelpe's (1979) checklist of the bryophytes of southern Africa, the species is also referred to as *Carrpos sphaerocarpos*, in the family Monocarpaceae D.J.Carr ex Schelpe. Schuster (1963) also considered *Carrpos*, as he called it, to belong to the Marchantiales and placed it in the monotypic suborder Carrpineae. In 1966, however, he incorporated it in the suborder Corsiniineae. Later on, Schuster (1984) again referred it to the suborder Carrpineae. Markham (1980) followed suit and referred to the species as *Carrpos sphaerocarpos*, stating that, on phytochemical evidence, *Carrpos* should be 'aligned near *Sphaerocarpos*, either in a separate suborder, or better, as Grolle (1972) had suggested, in a separate family'.

Grolle (1983) accepted Markham's 'strong biochemical evidence that a position in the Sphaerocarpales or close to the Sphaerocarpaceae may be more natural for this family than a placement in the Marchantiales as adopted by most authors following Carr'.

Scott (1985) followed Grolle, placing the Riellaceae, Sphaerocarpaceae and Monocarpaceae in the order Sphaerocarpales. In 1992 Schuster commented that this was done 'on surely erroneous bases'. In the present treatment, Grolle (1983) and Scott (1985) are followed.

Suborder **Monocarpineae**. Carr: 187 (1956).

Thalli terrestrial, ephemeral, reduced, pouch-like, medianly without an epidermis, open spaces formed above, separated by sloping or vertical septa; cells all thin-walled, oil bodies absent. Further growth sympodial by ventral sprouts, sometimes branched. *Ventral scales* and mucilage hairs lacking. *Rhizoids* all smooth, vertical.

Monoicous. *Antheridia* developed inside air chambers, stalk uniseriate, long, necrotic. *Archegonia* usually 3 per archegoniophore, but generally only 1 fertilised, neck with 6 canal cells. *Carpocephalum* closely surrounded by gametophytic tissue, its wall containing barrel pores opening into inner air chambers. *Capsule* with unistratose wall; cleistocarpous. *Seta* short, dark coloured, with bulbous foot. *Stalk* reduced, dark brown, lacking rhizoid furrow. *Spores* hemispherical, medium-sized, densely covered with fine tubercles, only released after dissolution of capsule wall and decay of surrounding gametophytic tissues. *Elaters* absent.

Monocarpaceae *D.J.Carr* in Australian Journal of Botany 4: 187 (1956).

Carrpaceae Prosk.: 375 (1961b).

The diagnoses of the monogeneric family and the monotypic genus are contained in the above description of the suborder Monocarpineae.

Monocarpus sphaerocarpus *D.J.Carr* in Australian Journal of Botany 4: 175 (1956). Type: Australia, northwestern Victoria, by the side of Calder Highway at Yatpool, adjacent to Red Cliffs, on bare mud of saltpan, August 1955, leg. *S.G.M. Carr* (née *Fawcett*) *s.n.* (MEL, holo.).

Carrpos sphaerocarpos (D.J.Carr) Prosk.: 155 (1961a).

Thalli ephemeral, gregarious, pouch-like, subspherical, somewhat flattened at poles, flanks slightly bulging, minute to small, 0.5–2.25 mm diam., up to 1.6 mm high (Figure 1A), mostly single-lobed, rarely double, pale green; outer, protective layers soon developing air spaces, at maturity closely surrounding carpocephalum (Figure 2A, B), which is usually single and subglobose,

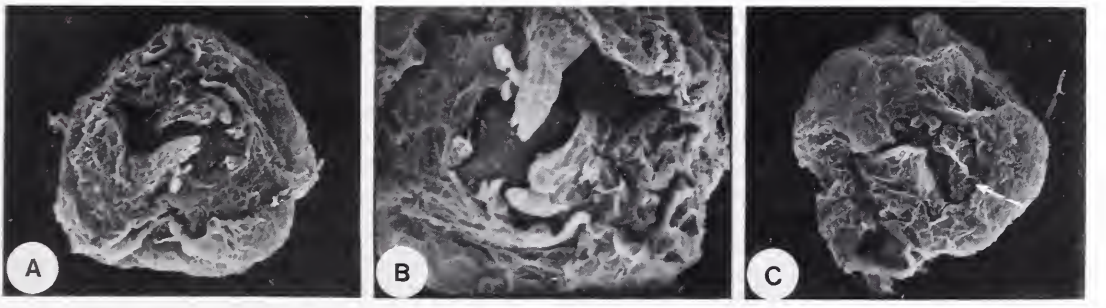

FIGURE 2.—*Monocarpus sphaerocarpus*. A, B, pouch-like thallus from above, outer protective layers closely surrounding carpocephalum, with cellular outgrowths from upper margin of pouch, arching over orifice at top; B, more enlarged; C, different thallus, showing unistratose septum (arrowed) and short, ventral sprout toward lower left corner. A–C, *Toelken 1586a*. A, × 34; B, × 53; C, × 35.

its uppermost wall remaining partly exposed, through which, brown colour of ripe spores and enclosing capsule wall visible; further growth of thallus by ventral sprouts (Figure 1C), which may be branched and have dorsally open air chambers; when dry, rather shrivelled, but otherwise not much altered, 'wings' of thallus regarded as being permanently in 'rolled up' state. *Pouch (or wing) tissue* at upper margin overarching and partly covering orifice over top of carpocephalum with cellular outgrowths (Figures 1B; 2A, B), sometimes even overlapping, terminal cells 30–40 × 25–30 µm, paler, but not glandular in appearance; cells in outer walls covering ± 2 rows of domed air chambers (Figure 1B), 4- or 5-sided, thin-walled, 40–75 × 22.5–50.0 µm, oil bodies absent, in fresh thalli containing many small chloroplasts, inner walls often bearing lamellae and complete or incomplete unistratose septa, these subdividing the air chambers, which are up to 450 µm high, 500 µm wide across base, into smaller ones, lacking photosynthetic filaments and opening toward inside through unspecialised openings into secondarily delimited cavities; before expansion of carpocephalum entire upper tissue consisting of elongated air spaces, apically open and separated by unistratose septa. *Basal part* of thallus fleshy, where supporting stalk of archegoniophore, without costa, scales and mucilage hairs absent; rhizoids produced only from underside of base of thallus, anchoring it to substrate, all vertical, smooth, lacking tubercles, colourless, 10–15 µm wide, not very numerous.

Monoicous. *Antheridia* with body ovoid, ± 80 µm wide, initially green, but white at maturity, pedicel uniseriate, disproportionately long and filamentous, turning brown and seemingly necrotic, arising from floor or lower part of walls of ordinary air chambers, mostly single per chamber, but difficult to find. *Archegonia* usually with 6 rows of neck cells and 4 lid cells, borne on archegoniophores. *Carpocephalum* (Figure 1C, D, F) with 1(2) receptacle(s), each with 1–3(–6) archegonia, but generally only one becoming fertilised, ± ovoid, up to 1475 × 1400 µm, wall hyaline, membranous, cells 5- or 6-sided, 70–125 × 55–105 µm, tapering slightly toward ends, in upper part interrupted by two-tiered barrel pores (Figure 1G), 75–150 µm apart, more or less evenly scattered; pores small, from above (Figure 1H) 6–8-sided, ± 15 × 20 µm, quite thick-walled, surrounded by a row of 6–8(9), radially arranged, small cells, 15–20 × 15–20 µm (occasionally some cells larger), often narrowing toward base, overlying inner, smaller pore (Figure 1I), ± square or rectangular, with surrounding 4 (or occasionally more) cells opening into narrow air chambers along inner wall of carpocephalum; chamber walls degenerate in older material and only strands of amorphous tissue with chloroplasts remaining; sometimes a thickened knot of heavily proliferated tissue observed in lateral wall of carpocephalum, here without air pores and air chambers, the cells almost rectangular and closely appressed, also reduced in size to 45–55 × 15–20 µm. *Stalk* short, up to 100 µm wide, 5 cell rows across, cells angular, 15–20 × 17.5–22.5 µm, walls dark brown, surrounding cells in carpocephalum wall (Figure 1J) reduced in size, 55–65 × 12.5–25.0 µm. *Capsule* at maturity practically filling space within carpocephalum, walls of both structures closely appressed; initially, however, its growth rate slower and young capsule only occupying part of space within (Figure 1C); capsule wall (Figure 1K) unistratose, brown, composed of thin, ± rectangular to somewhat irregularly shaped cells, 25–50 × 30.0–57.5 µm, along walls 2–4 small nodular to elongated thickenings, quite often joined into a continuous, uneven line, cells separating easily. *Seta* dark brown, only ± 100 × 50 µm, composed of central row of cells and marginally surrounded by 5 or 6 cells in tiers. *Foot* bulbous, ± 120 µm long, up to 100 µm wide, consisting of a cluster of cells. *Spores* at maturity, seemingly regardless of size of capsule, 42.5– 50.0 µm diam., dark brown, light brown spores presumably younger, 27.5–35.0 µm diam., hemispherical; distal face (Figure 3A–D) convex, densely covered with numerous fine tubercles, ± 2.5 µm long, in 18 or 19 rows across, some central ones crowned with a small papilla, others smooth, joined by low walls which enclose tiny, shallow pits; around spore periphery, many fine, projecting tubercles; proximal face (Figure 3E) without triradiate mark, slightly indented, central part also covered with fine tubercles separated by tiny pits, broad rim around margin (Figure 3E, F) without ornamentation, but not quite smooth; spore release occurring on dissolution of capsule wall and by decay of carpocephalum wall as well as surrounding thallus tissue. *Elaters* absent.

Distribution

In spite of a detailed map, kindly drawn and sent by Dr H. Toelken, now of the State Herbarium, Adelaide, Australia, and also my own repeated visits to the Baths Hotel grounds near Montagu in Western Cape (Figure 4), I have not succeeded in finding more material of this minute plant. My failure may perhaps be attributed to considerable building operations in the vicinity in recent years, possibly leading to the complete disappearance of the species from this locality.

Ecology

The plants grew on saline-gypsum soil in the winter rainfall region of Western Cape and appear to be extremely rare. According to Low & Rebelo (1996) the vegetation type in this locality is Central Mountain Renosterveld of the Fynbos Biome, sclerophyllous, microphyllous vascular plant vegetation (Cowling *et al.* 1997; Rutherford 1997). In Australia, mainly in NW Victoria, Scott (1985) reported them to be growing on salt-rich and gypsum-rich soils at salt pans, where the ground rises out of the saline influence but is kept moist.

DISCUSSION

Proskauer (1961b) complained of *Monocarpus sphaerocarpus* that, 'the material is difficult to handle. Not only are the cells delicate and readily damaged, but even the larger thalli (which in reality are still minute), have most awkward shapes'. I would readily agree with this observation. Proskauer also found that 'even the best special photographic lenses at the required magnifications lack the requisite depth of focus'. Fortunately, the SEM overcomes such problems, but, regrettably, I had no fresh material to study. Proskauer further commented that, 'the thallus proved to be rather more complex than described (by Carr), a discrepancy explained by the type field material having been both somewhat depauperate

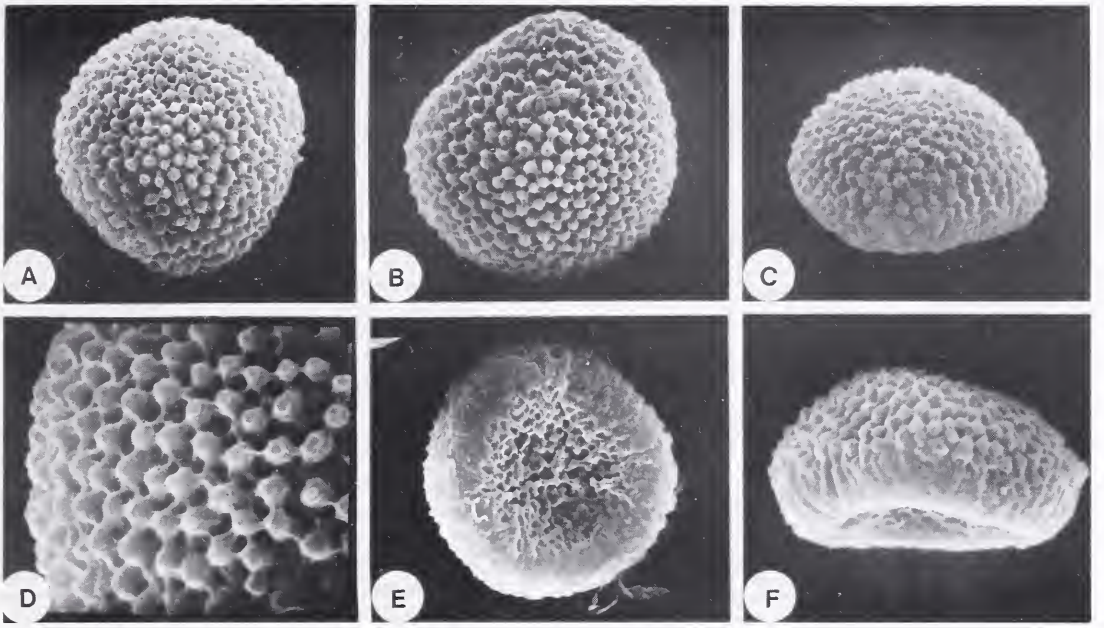

FIGURE 3.—*Monocarpus sphaerocarpus*. Spores. A, B, distal face; C, side view of distal face; D, detail of margin of distal face; E, proximal face; F, side view. A–F, *Toelken 1586a*. A, × 805; B, × 909; C, × 933; D, × 2312; E, × 852; F, × 1017.

and precociously fertile, with the expanding archegoniophore compressing the vegetative tissues'. Poor environmental conditions and harvesting prior to maturation of the spores were held responsible for this (Proskauer 1961b). To these observations I would like to add that the South African field-grown thalli (although considerably smaller), are more easily matched with Carr's descriptions and illustrations than with the elongated, richly sprouting and branched thalli, cultivated on various media under artificial conditions (on a window sill), that were illustrated and described by Proskauer. He found, significantly, that different media influenced the size of the plants. Scott's (1985) photograph of *Monocarpus sphaerocarpus* also shows rounded, pouch-like thalli, sometimes 2-lobed, but lacking elongated ventral sprouts.

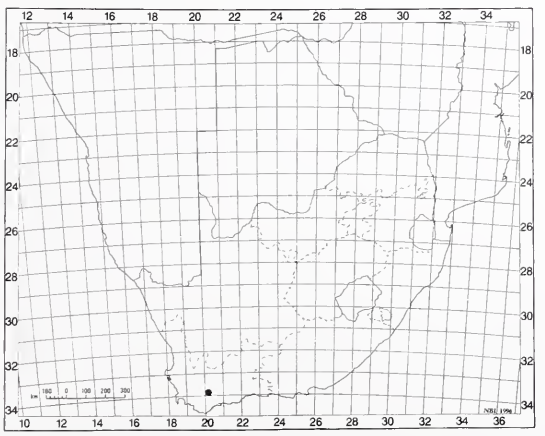

FIGURE 4.—Distribution of *Monocarpus sphaerocarpus* in southern Africa.

Carr (1956) described the barrel pores of the 'involucre' (= carpocephalum) as frequently having 6–8 epidermal cells and only 4 hypodermal cells, with a much larger, generally octagonal or hexagonal outer pore and a small, roughly square or rectangular inner pore. In unfertilised material that he examined, Proskauer on the other hand, generally found only 4 cells in each of the outer and inner rings of cells, although not uncommonly, there were also pores with up to 8 cells in the outer, as well as in the inner ring; a few pores, apparently, showed a considerably wider external than internal opening. My findings on the pores match those of Carr more closely.

A suture representing the closure of the mouth of the 'involucre', where the cells were clavate and much larger than the other 'involucral' cells, was described by Carr (1956). According to Proskauer, the occlusion of the receptacle, described by Carr as 'a routine post-fertilisation change, did not take place'. I cannot comment on this, not being able to study living material at different stages of development. It is possible that the 'thickened knot of heavily proliferated tissue' I observed in the carpocephalum wall, may represent the closure of the mouth, but this needs to be verified.

Carr referred to meiosis not being simultaneous throughout the sporogenous tissue, whereas Proskauer strongly doubted that meiosis in a sporophyte was other than simultaneous, but could not prove this, because he lacked suitable material. Proskauer, furthermore, suspected that Carr's sporelings seemed to have resulted from leptosporangiate fern spores. In the smallish to medium-sized capsules that I examined, no 'sterile cells' (Carr 1956; Proskauer 1961b) were observed. Carr, indeed, remarked that 'they may be entirely absent from very large capsules'.

ACKNOWLEDGEMENTS

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REFERENCES

BULLOCK, A.A. 1961. Our Corpus and *Carrpos*—a reply. *Taxon* 10: 240–242.

CARR, D.J. 1956. Contributions to Australian Bryology. 1. The structure, development, and systematic affinities of *Monocarpus sphaerocarpus* gen. et sp. nov. (Marchantiales). *Australian Journal of Botany* 4: 175–191.

COWLING, R.M., RICHARDSON, D.M. & MUSTART, P.J. 1997. Fynbos. In R.M. Cowling, D.M. Richardson & S.M. Pierce, *Vegetation of southern Africa*. Cambridge University Press, Cambridge.

GROLLE, R. 1972. Die Namen der Familien und Unterfamilien der Lebermoose (Hepaticopsida). *Journal of Bryology* 7: 201–236.

GROLLE, R. 1983. Nomina generica hepaticarum: references, types and synonymies. *Acta Botanica Fennica* 121: 1–62.

LOW, A.B. & REBELO, A.G. (eds) 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.

MAGILL, R.E. & SCHELPE, E.A. 1979. The bryophytes of southern Africa. An annotated checklist. *Memoirs of the Botanical Survey of South Africa* No. 43.

MARKHAM, K.R. 1980. Phytochemical relationships of *Carrpos* with *Corsinia* and other Marchantialean genera. *Biochemical Systematics and Ecology* 8: 11–15.

MIQUEL, F.A.G. 1865. *Annales musei botanici lugdunobatavi* 2: 12.

PEROLD, S.M. 1999. Hepatophyta. Part 1: Marchantiopsida, Fascicle 1: Marchantiidae. *Flora of southern Africa*. National Botanical Institute, Pretoria.

POST, T.E. & KUNTZE, O. 1903. *Lexikon generum phanerogamarum*.

PROSKAUER, J. 1955. The Sphaerocarpales of South Africa. *Journal of South African Botany* 21: 63–75.

PROSKAUER, J. 1961a. Our Corpus and *Carrpos*. *Taxon* 10: 155, 156.

PROSKAUER, J. 1961b. On *Carrpos* I. *Phytomorphology* 11: 359–378.

RUTHERFORD, M.C. 1997. Categorization of biomes. In R.M. Cowling, D.M. Richardson & S.M. Pierce, *Vegetation of southern Africa*. Cambridge University Press, Cambridge.

SCHELPE, E.A.C.L.E. 1969. Three new records of southern hemisphere Bryophyta for South Africa. *Journal of South African Botany* 2: 109–112.

SCHUSTER, R.M. 1963. Studies on Antipodal Hepaticae. *Journal of the Hattori Botanical Laboratory* 26: 185–309.

SCHUSTER, R.M. 1966. *The Hepaticae and Anthocerotae of North America* 1: 381–387. Columbia University Press, New York and London.

SCHUSTER, R.M. 1984. Evolution, phylogeny and classification of the Hepaticae. *New Manual of Bryology* 2: 892–1070. The Hattori Botanical Laboratory, Nichinan, Miyazaki, Japan.

SCHUSTER, R.M. 1992. *The Hepaticae and Anthocerotae of North America* 6: 1–937. Field Museum of Natural History, Chicago.

SCOTT, G.A.M. 1985. *Southern Australian liverworts*. Australian Flora and Fauna Series, No. 2.

VOSS, E.G., BURDET, H.M., CHALONER, W.G., DEMOULIN, V., HIEPKO, P., MCNEILL, J., MEIKLE, R.D., NICOLSON, D.H., ROLLINS, R.C., SILVA, P.C. & GREUTER, W. 1983. *International Code of Botanical Nomenclature*, adopted by the 13th International Botanical Congress, Sydney, Aug. 1981. Bohn, Scheltema & Holkema, Utrecht/Antwerpen.

WIGGLESWORTH, G. 1937. South African species of *Riella*, including an account of the developmental stages of three of the species. *Journal of the Linnean Society, Botany* 51: 309–332.

Bothalia 29,2: 231–237 (1999)

Three new species of *Zygophyllum* (Zygophyllaceae) from Namibia and Northern Cape, South Africa

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Keywords: Namibia, new species, Northern Cape, South Africa, Zygophyllaceae, *Zygophyllum*

ABSTRACT

Three new species of *Zygophyllum* L. from the lower Orange River area in Namibia and Northern Cape, South Africa are described, namely, *Z.* **applanatum** Van Zyl, *Z.* **hirticaule** Van Zyl and *Z.* **pterocaule** Van Zyl.

INTRODUCTION

Since the publications of Sonder (1860), Van Huyssteen (1937) and Schreiber (1963), several new species of *Zygophyllum* have come to light. Most of them were found in the lower Orange River basin forming part of the northern zone of the winter rainfall area of the arid Karoo-Namib region of southern Africa. When dealing with taxa in this area, Nordenstam (1966) suggested the term 'Gariep element' for these extreme xerophytic species that constitute a significant phytogeographical group. Cowling & Hilton-Taylor (1997) considered the Gariep area, falling within the Succulent Karoo Biome, as one of the centres of exceptional species endemism in southern Africa. El Hadidi (1978) considered the arid zones of Namibia and South Africa, including the Gariep element, to be of importance as a second centre of origin for taxa belonging to Zygophyllaceae, native to the Old World.

The genus *Zygophyllum* is well represented in the Gariep element, with seven out of the 18 Namibian species recognised by Schreiber (1963), occurring there. Recent discoveries add another nine new species of *Zygophyllum* to Schreiber's list, all occurring in the Gariep area. In this paper, three of these new species of *Zygophyllum* are described.

Zygophyllum applanatum Van Zyl was first collected by Dinter during 1922–1929, after which this tiny, but locally abundant plant, was missed by other collectors until recently. He recognised it as a new species and used the *nom. nud.* '*adpressum*' on herbarium sheet *Dinter 6614* (BOL), whereas Schreiber (1963) considered this sheet to be a hybrid between *Z. clavatum* Schltr. & Diels and another *Zygophyllum* species with longer capsules. Subsequent collections and field observations made by me convinced me that *Z. applanatum* is a new species. *Z. hirticaule* Van Zyl was discovered by Oliver & Muller in 1976 and *Z. pterocaule* Van Zyl was first collected by Muller in 1977. Both *Z. applanatum* and *Z. pterocaule* belong to the subgenus *Agrophyllum* Endl. section *Bipartita* Huysst., with divided staminal scales as an important characteristic, whereas *Z. hirticaule* belongs to the subgenus *Zygophyllotypus* Huysst. section *Capensia* Engl., with undivided staminal scales.

Young stems of *Zygophyllum* species display taxonomically useful characteristics in cross section. In § *Capensia*, internodes are often ventrally flattened, with or without lateral ridges, whereas § *Alata* is characterised by a distinct ventral groove (Van Zyl & Marais 1997). In § *Bipartita* the young stems of a few species are winged in a dorsiventral plane, usually with a single ventral wing. *Z. pterocaule* displays both a dorsal and ventral wing. Figure 1.

Zygophyllum pterocaule *Van Zyl*, sp. nov. (§ *Bipartita*), *Z. prismatocarpo* Sond. affinis sed fruticulus decumbens ramulis dorsiventraliter alatis. Figura 2.

Fruticulus decumbens, ad 0.15 m altus, ± 0.8 m diametro. *Ramuli* alis duobus plano dorso ventrali. *Folia* opposita, sessilia, simplicia, orbiculata, articulata, amplitudine diminuentia apicem versus. *Sepalum* externum succulentum, cuccullatum. *Petala* spathulata, alba. *Discus* 5-lobatus, lobis indentatus. *Stamina* 10. *Squama* staminalis bipartitae, ovatae vel ellipticae, marginem integri. *Ovarium* cylindricum, 5-lobatum. *Fructus* capsula septicida, viva succulenta, 5-lobata, mollis; desiccata 5-angulata, 9 × 6 mm. *Semina* multa, fusca, pyriformia, 2 × 1 mm, quam funiculis longiora, tecta madida mucum sine structura procreans.

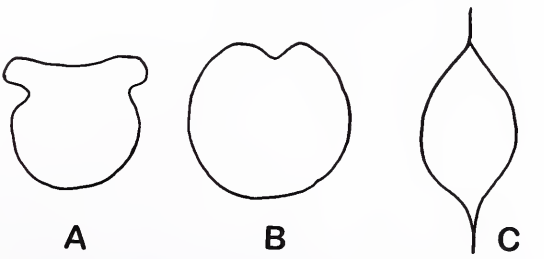

FIGURE 1.—Section through internodes. A, *Zygophyllum fuscatum, Van Zyl 4293* (§ *Capensia*); B, *Z. suffruticosum* Schinz, *Van Zyl 3809* (§ *Alata*); C, *Z. pterocaule* Van Zyl, *Van Zyl 4478* (§ *Bipartita*).

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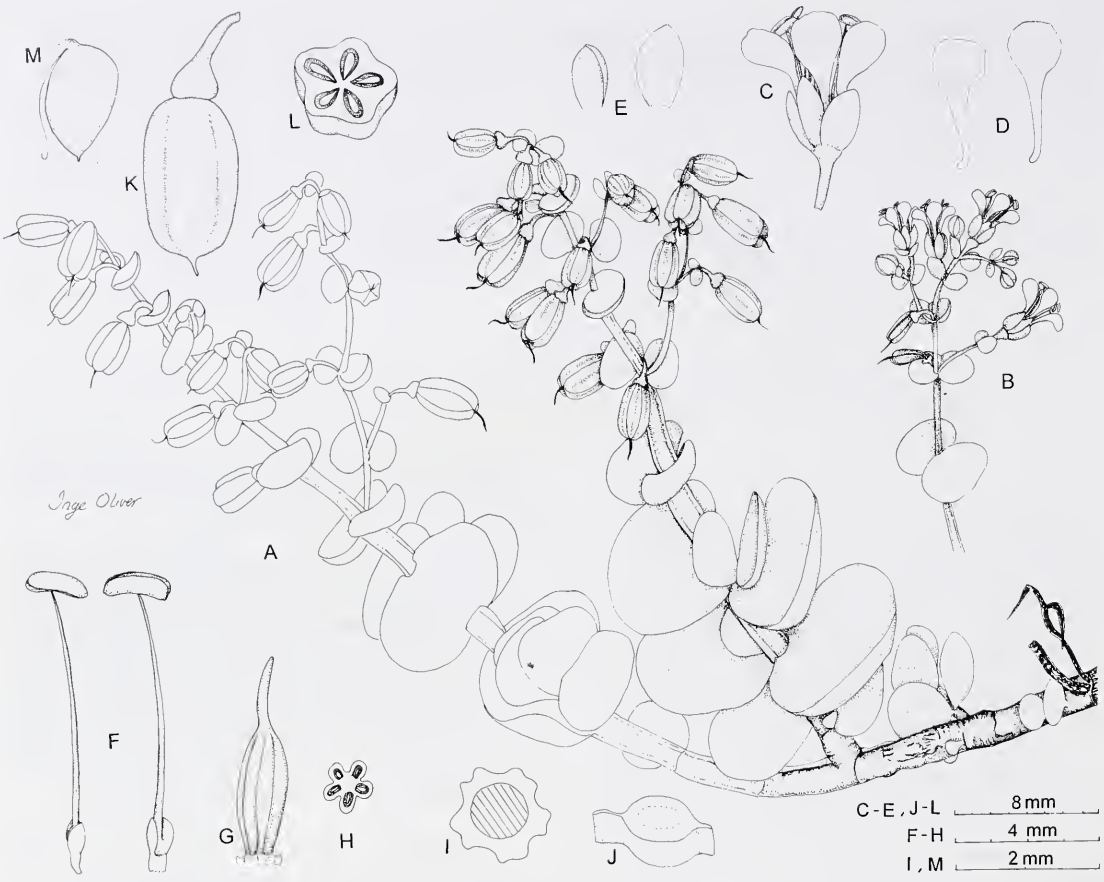

FIGURE 2.—*Zygophyllum pterocaule*, *Van Zyl 4478*. A, fruiting branch, life size; B, flowering branch, life size; C, side view of flower; D, petals; E, sepals; F, stamens with staminal scale, side and ventral view; G, ovary; H, section of ovary; I, section of nectar disc; J, section of internode; K, fresh capsule; L, section of fresh capsule; M, immature seed. Scale bars: C–E, J–L, 8 mm; F–H, 4 mm; I, M, 2 mm. Artist: Inge Oliver.

TYPE.—Northern Cape: Cornellskop, west of Khubus, Richtersveld, (–BD), *Van Zyl 4136* (NBG, holo.; B, PRE, S, WIND).

Decumbent, succulent, branched shrublet up to 0.15 m high and 0.8 m diam. *Stems*: old stems woody, brown, with swollen nodes and rough textured bark; young branches grey, smooth, internodes visible and with two prominent wings in a dorsiventral plane (Figure 1C). *Leaves* opposite, sessile, simple, glaucous; lamina articulate, suborbicular, succulent, 20–30 × 20–30 mm, gradually reduced in size towards branch apex; stipules filamentous, caducous, vestigial. *Flowers* solitary or two together, axillary; pedicel 4–9 mm long. *Sepals* 5, suborbicular to obovate, outer 3 succulent with scarious margins, cuculate, articulate, 4.0–5.5 × 2.0–3.5 mm. *Petals* 5, spathulate, 7.0–9.5 × 2.5–3.0 mm, white, margins sometimes undulate. *Nectar disc* fleshy, smooth, 10-lobed; lobes arranged in 5 pairs, orientated downwards, each pair with a raised central area and with a sunken area between pairs, disc has a hole sloped towards its periphery. *Stamens* 10; filaments terete, 6–7 mm long; staminal scales bilobed, segments ovate to elliptic, margins entire, 1.5–0.7 mm, ± $^1/_5$ as long as filament. *Ovary* cylindrical, 5-lobed; style terete; stigma simple. *Fruit* a septicidal capsule: when fresh, succulent, drooping, 5-lobed, cylindrical, interlocular areas filled with a sticky juice, 9–6 mm; when dried, somewhat shrunken in size, prominently 5-angular, each locule containing up to 10 seeds which are glued to the walls. *Seed* pyriform, 2 × 1 mm, brown, attached with a long funicula; testa granular, hyalinous, producing structureless mucilage when wet. Figure 2.

Diagnostic characters

The most prominent features of *Zygophyllum pterocaule* are the suborbicular, simple leaves and young stems with two wings (hence the specific epithet which is Greek for winged stem). It is allied to *Z. prismatocarpum* Sond., also in section *Bipartita*, with regard to leaf and floral morphology, but differs in habit. *Z. pterocaule* has a decumbent habit, reaching a height of only 0.15 m, whereas *Z. prismatocarpum* is an erect shrub of up to 1.0 m or more and has only one wing on its young stems.

Sterile *Z. pterocaule* could also be confused with *Z. cordifolium* L.f. (§ *Paradoxa,* subgenus *Zygophyllotypus*) because of simple, suborbicular leaves and a decumbent habit, but the presence of the two wings on

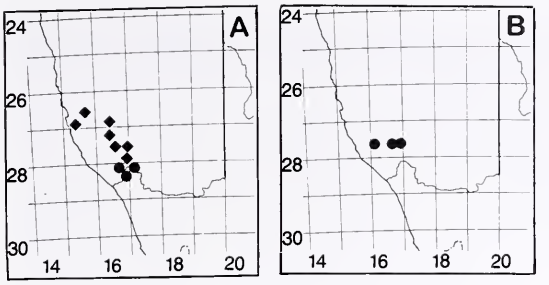

FIGURE 3.—Distribution of *Zygophyllum*. A, *Z. pterocaule* Van Zyl, ●, and *Z. applanatum* Van Zyl, ◆. B, *Z. hirticaule* Van Zyl, ●.

the stems of the former species should, however, prevent confusion. The distribution of these two species sometimes overlap. When flowering, the small, 10 mm long, white flowers of *Z. pterocaule* should easily be distinguished from the larger, 14–18 mm long, prominently marked, yellow flowers of *Z. cordifolium*.

Distribution and habitat

Z. pterocaule has a limited distribution in the lower Orange River basin (Figure 3A). On the Namibian side, collections were made at the Schakalsberge and between the confluence of the Boom and Dabimub Rivers with the Orange River. Collections were also made on Çornellskop and at Annisfontein, to the western side of the Richtersveld National Park in the Northern Cape. The vegetation on the South African side of the distribution area is classified by Hoffman (1996) as Lowland Succulent Karoo, occurring below the escarpment on rich soils derived from granite and gneiss, representing an extremely arid vegetation type. The dominant plants are dwarf shrubs belonging to the Mesembryanthemaceae. Rainfall varies from 50–200 mm annually during the winter months and summers are hot and dry. Irish (1994) describes the vegetation on the Namibian side as Namibian Succulent Karoo, characterised by chamaephytic dominance and a much lower rainfall than the Succulent Karoo of South Africa.

Plants of this species were observed growing on limestone-rich, stony soils, on slight slopes and in dry stream beds, always in association with other *Zygophyllum* species. No shedding of leaves was observed possibly because, in this case, the leaves are succulent and serve as storage organs for water. Flowering occurs from July to October while shedding of ripe seeds occurs months later. Ripening of fruits and seeds of *Z. pterocaule* takes longer than most other species in this genus because of the very succulent nature of the fruit. Although no grazing damage to this species was observed, the small size of populations and the absence of seedlings or young plants were noticeable and therefore this species could be considered as vulnerable.

Specimens examined

NAMIBIA.—2816 (Oranjemund): Schakalsberge, in dry stream bed, (–BA), *Muller 768* (PRE, WIND). 2817 (Vioolsdrif): between Boom and Dabimub Rivers along Orange River, (–AA), *Van Zyl 4478*, (NBG, WIND).

NORTHERN CAPE.—2816 (Oranjemund): Annisfontein, Richtersveld, (–BD), *Jurgens 22160* (PRE); north of Annisfontein, Richtersveld, (–BD), *Pillans 5005* (K); Cornellskop, Richtersveld, (–BD), *Van Jaarsveld, Forrester & Jacobs 8584* (NBG, PRE); *Van Zyl 4064* (NBG, PRE), *4136* (B, NBG, PRE, S, WIND).

Zygophyllum applanatum *Van Zyl*, sp. nov., (§ *Bipartita*), *Z. clavato* Schltr. & Diels affinis sed fruticulis prostratus, fructibus cylindricus, Figura 4.

Fruticulus prostratus. *Rami* albi, coriacei, ramuli ventraliter debiliter sulcati. *Folia* opposita, bifoliata, petiolata, ramulis floriferis unifoliata vel sessilia, foliola subrotunda, articulata. *Sepala* exteriora succulenta, cucullata. *Petala* spathulata, alba. *Discus* 5-lobatus, lobis indentatus. *Squamae* staminalis bipartitae, longitudine $^1/_2$ filamentorum partes aequantes. *Ovarium* cylindricum. *Fructus* capsula septicida, seminibus multis, viva cylindrica, desiccata 5-angulata. *Semina* pyriforma, quam funiculis longiora, tecta madida mucum sine structura procreans.

TYPE.—Namibia, 2615 (Luderitz): Haalenberg, E of Luderitz, (–DA), *Van Zyl 3865* (NBG, holo.; B, PRE, S, WIND).

Small, semiprostrate shrublet, branched from base, up to 0.2 m diam., mostly quite prostrate but after good rains resprouting from centre, reaching a height of 100 mm. *Stems*: old stems white, coriaceous, horizontal, up to 100 mm long; young branches greenish brown, round to elliptical in section with a poorly developed ventral groove. *Leaves* opposite, petiolate, glaucous, bifoliolate, on flowering branches gradually reduced to a unifoliolate, sessile state; leaflets articulate, subrotund, slightly fleshy, 4–7 × 4–7 mm, base sometimes cuneate; petiole articulate, cylindrical, 1–3 mm long; stipules membranous, caducous, reddish brown, triangular, apex sometimes incised, 0.5 × 2.0 mm. *Flowers* solitary, axillary; pedicel 1–3 mm long. *Sepals* 5, ovate to elliptic, outer 3 succulent, cuculate, 2.0–3.5 × 1.0–1.5 mm. *Petals* 5, spathulate, 3.0–4.0 × 1.5 mm, apex acute or rounded, base long-clawed, white. *Nectar disc* fleshy, granular, 5-lobed, each lobe indented. *Stamens* 10; filaments terete, 2–4 mm; staminal scales 10, bipartite, ovate to elliptic, segments oblong, apex somewhat acute, base narrowed, margins entire, 1.3–1.8 × 0.4–1.0 mm, ± half as long as filament. *Ovary* cylindrical, covered with translucent globules; style terete, short; stigma simple. *Fruit* a septicidal capsule: when fresh, succulent, drooping, cylindrical with faintly visible sutures; when dried somewhat shrunken in size, 5-angled, cylindrical, 12 × 4 mm. *Seed* pyriform, 1–8 per locule, 1.5 × 0.6 mm, light brown, long funicle present, testa granular, hyalinous, producing structureless mucilage when wet. Figure 4.

Diagnostic characters

Zygophyllum applanatum is closely allied to *Z. clavatum* Schltr. & Diels with regard to leaf and floral characters but is readily distinguishable by its fruits and habit. *Z. clavatum* has an erect habit, up to 500 mm high, whereas *Z. applanatum* grows horizontally (hence the specific epi-

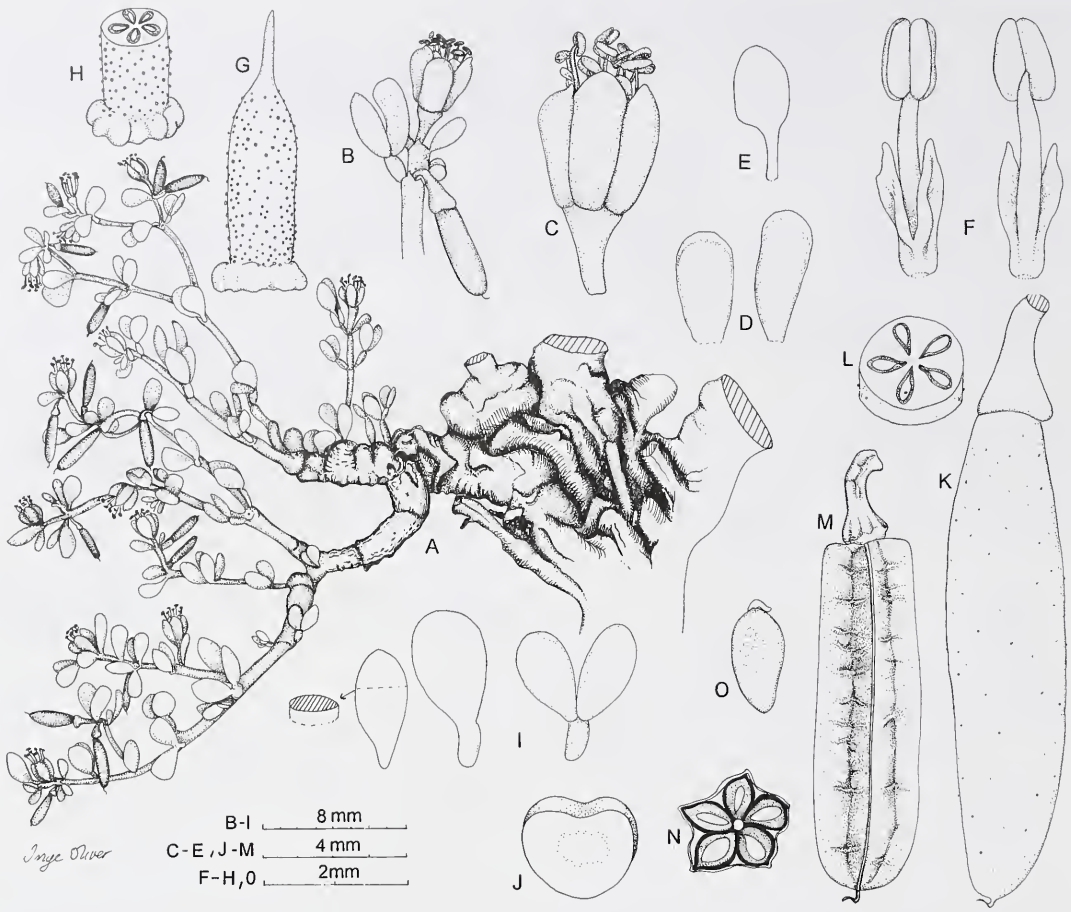

FIGURE 4.—*Zygophyllum applanatum*, *Van Zyl 4482*. A, flowering and fruiting branch, life size; B, twig with flower, leaf and young fruit; C, side-view of flower; D, sepals; E, petal; F, stamens with staminal scale, dorsal and ventral side; G, ovary; H, section of ovary; I, range of leaves plus section; J, section of internode; K, fresh fruit; L, section of fresh fruit; M, dried fruit; N, section of dried fruit; O, seed. Scale bars: B–I, 8 mm; C–E, J–M, 4 mm; F–H, O, 2 mm. Artist: Inge Oliver.

thet which is Latin for flattened or horizontally expanded). During exceptionally good rainfall seasons *Z. applanatum* can grow to 100 mm high by resprouting from the centre, so displaying an atypical habit. Unfortunately the illustration (Figure 4), depicting this taxon was done from atypical material, giving a false impression of the habit. A photograph which was taken during an ordinary rainfall season (Figure 5), is included to remedy this. Both taxa have septicidal capsules but they differ in shape. Dried fruits of *Z. applanatum* are cylindrical, 5-angled and up to 12 × 4 mm, whereas those of *Z. clavatum* are wider than long, 5-partite, 2.5 × 4.0 mm. *Z. applanatum* with its limited distribution is restricted to the winter rainfall area, whereas *Z. clavatum* occurs in a much larger area with both winter and summer rainfall, sometimes overlapping with the former species.

Distribution and habitat

Zygophyllum applanatum is found in a small area in the southern part of Namibia. Several collections were made around Luderitz, south of Aus and towards Witputz and Rosh Pinah (Figure 3A). The vegetation in this area is classified as Succulent Karoo Biome dominated by chamaephytes (Irish 1994). Rainfall occurs during winter with occasional light snowfalls around Aus. Average annual precipitation varies from 40–90 mm, which is lower than the similar Succulent Karoo Biome in South Africa. Summers are hot and dry with frequent periods of drought. In the restricted areas belonging to the mining groups and where little or no farming activity occurs, populations consisting of hundreds of plants, including many seedlings and young plants, were observed growing on chalky, desert flats often in association with other *Zygophyllum* species. *Z. applanatum* appears to be edible because in the sheep farming areas around Aus, plants were nearly absent inside grazing camps, whereas on the road shoulders they were common. Leafless plants were observed during dry periods and it can be assumed that leaf shedding occurs as a survival strategy during droughts. Flowering and fruiting were recorded during August to December. The succulent nature of the fruits causes a delay in shedding of ripe seeds and this usually occurs only months after flowering.

FIGURE 5.—*Zygophyllum applanatum* Van Zyl. Photo taken during a normal rainfall season.

Specimens examined

NAMIBIA.—2615 (Luderitz): hills E of Grillenthal, S of Luderitz, (–CD), *Van Zyl 3879* (NBG, PRE, WIND); 14 km S of Grasplatz, towards Grillenthal, (–CD), *Van Zyl 3868* (NBG, PRE); Haalenberg, E of Luderitz, (–DA), *Van Zyl 3865* (B, NBG, PRE, S); *Dinter 6614* (B, BOL, Z). 2616 (Aus): Kubub 15, Tsamvlakte, S of Aus, (–CD), *Van Zyl 3881* (NBG, PRE). 2716 (Witputz): Arutal 25, 28 km S of Aus, (–AB), *Van Zyl 3886* (B, NBG); Pochenbank 68, 70 km S of Aus, (–AB), *Van Zyl 3891a* (NBG); Kuckaus, (–AB), *Dinter 3724* (B); Nord Witputz 22, 55 km N of Rosh Pinah, (–DA), *Van Zyl 3896b* (NBG); Witputz, (–DA), *Dinter 8078a* (B); Arimas 83, NE of Rosh Pinah, (–DB), *Van Zyl 4482* (NBG, PRE, WIND); plains at entrance to Rosh Pinah, (–DD), *Van Zyl 4470* (B, NBG, PRE, S, WIND).

Zygophyllum hirticaule *Van Zyl*, sp. nov., (§ *Capensia),* suffrutex multicaulis, a speciebus aliis sectionis ramulis pedunculisque hirsutis, fructo rubiginoso, alato tomentosoque distinguitur. Figura 6.

Suffrutex multicaulis. *Rami* eburnei, ramuli hirsuti; internodia rotunda vel ventraliter complanata, sine costata. *Folia* sessilia; foliola glauca, obovata. *Squama* staminales simplices, ellipticae, margine et superficiebus ambatus in dimidio superiore papillatae, tomentosum, apice retuso. *Fructus* capsula loculicida, rubiginosa, oblonga, 5-angulata, lateribus tomentosis, alisque angustis, glabrescentibus. *Semina* arillo albo, testa madida mucum contentis prominantibus spiralibus procreans.

TYPE.—Namibia, 2716 (Witputz): Nord Witputz 22, 55 km N of Rosh Pinah, (–CB), *Van Zyl 3894* (NBG, holo.; B, PRE, S, WIND).

Compact shrublet, branched from base, up to 0.3 m high and 0.5 m diam. *Stems*: old stems glabrous with swollen nodes and ivory-coloured bark; young stems hirsute, round in section or ventrally flattened but without lateral ridges. *Leaves* opposite, sessile, bifoliolate, glaucous when fresh, when dried, leathery in texture and displaying numerous, embedded crystals resulting in an uneven, warty texture, glabrous to glabrescent on margins and at base; leaflets articulate, asymmetrical, obovate, 20–40(47) × 13–25(34) mm, apex rounded, base mostly cuneate; stipules fleshy, caducous, triangular or subrotund, margins fringed, tomentose on dorsal side, one on ventral side and one on dorsal side of stem, 2–3 × 3–6 mm. *Flowers* solitary or two together, axillary; pedicel densely hirsute, up to 20 mm long. *Sepals* 5, ovate, tomentose on dorsal side, green, changing to burgundy when dry, persistent, 8 × 4–5 mm. *Petals* 5, patent, elliptic to obovate, 10–13 × 5–8 mm, apex rounded or accuminate, base with short claw, pale yellow. *Nectar disc* fleshy, papillose, 10-angled. *Stamens* 10; filaments terete, 7–8 mm long; staminal scales 10, simple, oblong with a slightly rounded apex, margin and upper half of both surfaces papillate, 3.5–4.0 × 1.5 mm, ± $^1/_2$ as long as filament. *Ovary* oblong, 5-angled, tomentose with 5 glabrous wings, apex retuse; style terete; stigma simple. *Fruit* a loculicidal capsule with ± same shape when fresh or when dried; oblong, 5-angled and 5-winged, with reddish, tomentose sides and narrow, glabrescent wings, 13–17 × 11–13 mm. *Seed* oblong, in 2–3-seeded loculi, 4 × 2 mm, brown with a white aril, testa smooth, translucent, producing brown mucilage with prominent spiral inclusions when wet.

Diagnostic characters

Zygophyllum hirticaule is distinguished by its hirsute young branches and pedicels (hence the specific epithet which is Latin for hairy stems) and by the reddish, tomentose capsule with narrow, glabrous wings. These fruits resemble those of *Z. debile* Cham. in colour and shape but in the latter the indumentum is lacking. These two species occupy completely different distribution ranges. *Z. hirticaule* stands somewhat on its own within section *Capensia* and has no close affinities with others in the group.

Distribution and habitat

Z. hirticaule is found in the southwestern part of Namibia (Figure 3B). Collections were made around Witputz and Kolke, N of Rosh Pinah. Irish (1994) classifies the vegetation in this area as Succulent Karoo Biome characterised by chamaephytic dominance. Summers are hot and dry with frequent periods of drought. Rainfall

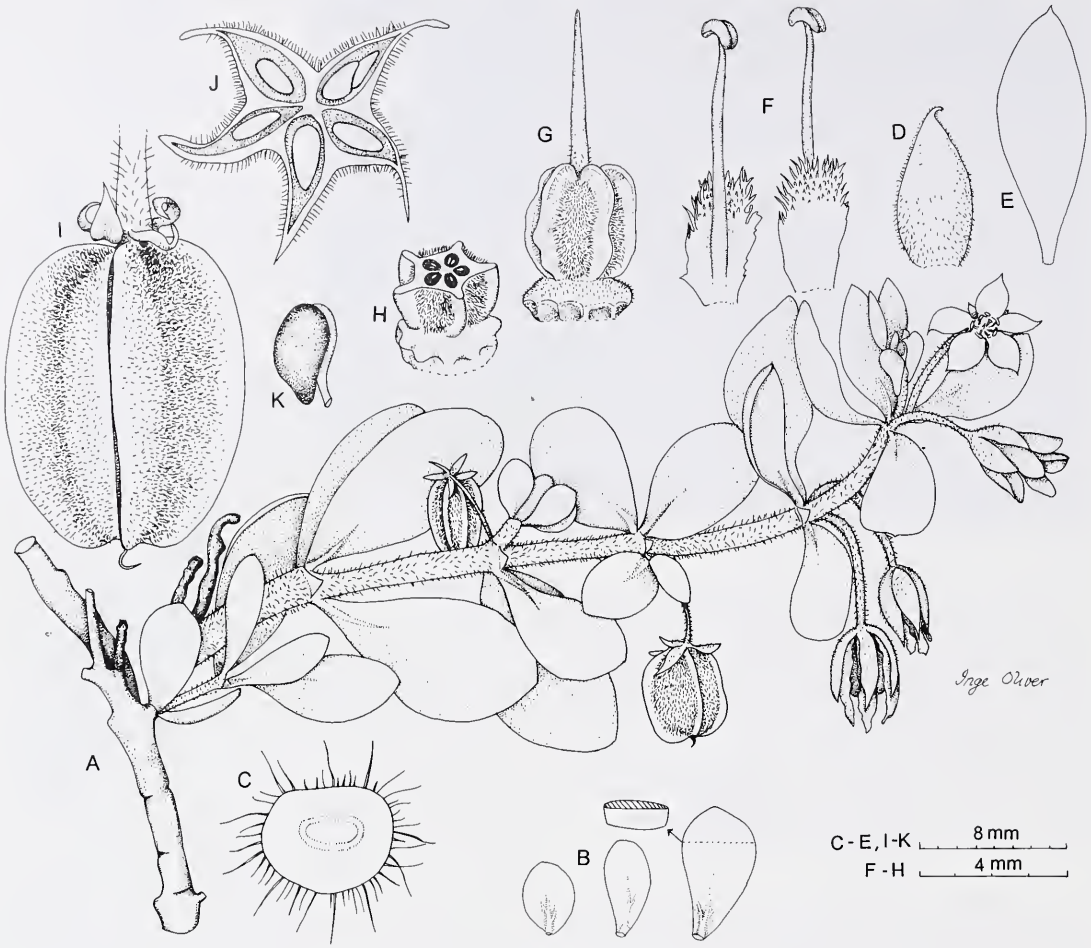

FIGURE 6.—*Zygophyllum hirticaule*. A–H, *Van Zyl 4480*; I, J, *Van Zyl 3902*. A, flowering and fruiting branch, life size; B, range of leaves plus section, half size; C, section of internode; D, sepal; E, petal; F, stamens with staminal scale, dorsal and ventral side; G, ovary; H, section of ovary; I, dried fruit, × 3; J, section of dried fruit, × 3; K, seed. Scale bars: C–E, I–K, 8 mm; F–H, 4 mm. Artist: Inge Oliver.

occurs during winter months with a yearly average ranging between 40 and 90 mm. Large populations were seen, including many seedlings and juveniles, growing on sparsely vegetated, stony, desert flats of a dolomitic and doleritic nature. A survival strategy, like so many species of this genus, seems to be the ability to shed leaves during periods of water stress. The remaining ivory-coloured stems of the leafless plants appear lifeless, but after the first rains they 'come alive' with leaves. Little evidence of grazing was seen and as farming activities in this area do not include ploughing, this species is at present under no threat. A specimen much resembling this species, but totally glabrous, was collected at Delphin kopf, Spencer Bay (*Giess & Robinson 13206,* WIND). This locality falls within a restricted mining area and in sandy desert terrain. For a final opinion on this specimen, better field observation and more collections are necessary.

Specimens examined

NAMIBIA.—2716 (Witputz): Aurusberg, NW of Rosh Pinah, (–CA), *Muller 740* (WIND); Witputz Nord 22, 55 km N of Rosh Pinah, (–DA), *Van Zyl 3894* (B, NBG, PRE, S, WIND); Witputz Sud 31, N of Rosh Pinah, (–DA), *Van Zyl 3902* (NBG, PRE, WIND); *Oliver & Muller 6406* (PRE); Kolke 84, N of Rosh Pinah, (–DB), *Van Zyl 4480* (NBG, WIND).

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REFERENCES

COWLING, R.M. & HILTON-TAYLOR, C. 1997. Phytogeography, flora and endemism. In R.M. Cowling, D.M. Richardson & S.M. Pierce, *Vegetation of southern Africa*. Cambridge University Press, Cambridge.

EL HADIDI, M.N. 1978. Adumbratio Florae Aethiopicae 30. Zygophyllaceae. *Webbia* 33: 45–101.

HOFFMAN, T. 1996. Lowland Succulent Karoo. In A.B. Low & A.G. Rebelo, *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs & Tourism, Pretoria.

IRISH, J. 1994. The Biomes of Namibia as determined by objective categorisation. *Navorsinge van die Nasionale Museum, Bloemfontein*.

NORDENSTAM, B. 1966. *Euryops* in South West Africa. *Botaniska Notiser* 119: 475–485.

SCHREIBER, A. 1963. Die Gattung *Zygophyllum* L. in Südwestafrika. *Mitteilungen der Botanischen Staatssammlung, München* 5: 49–114.

SONDER, O.W. 1860. Zygophyllaceae. In W.H. Harvey & O.W. Sonder, *Flora capensis* 1: 355–365. Reeve, Ashford, Kent.

VAN HUYSSTEEN, D.C. 1937. *Morphologisch-systematische Studien über die Gattung* Zygophyllum *mit besonderer Berücksichtigung der afrikanischen Arten.* Inaugural-Dissertation der Mathematisch-Naturwissenschaftlichen Fakultät der Friedrich Wilhelms-Universität zu Berlin.

VAN ZYL, L. & MARAIS, E.M. 1997. Two new species of *Zygophyllum* (Zygophyllaceae) from the Western Cape, South Africa. *Bothalia* 27: 129–133.

Bothalia 29,2: 239–247 (1999)

FSA contributions 13: Ulmaceae

C.M. WILMOT-DEAR*

Trees or shrubs, monoecious or dioecious, sometimes spiny. *Leaves* alternate, simple, blade often unequal-sided at base; stipules lateral and free or amplexicaul and connate, caducous. *Flowers* unisexual or bisexual, regular, axillary, solitary or in cymes or clusters. *Perianth* of (4–)5 tepals, imbricate or valvate, free or shortly united, persistent. *Stamens* as many as, and opposite, tepals, inserted at base of perianth, erect in bud; anthers 2-thecous, opening longitudinally. *Ovary* superior, 2-carpellate, 1-locular; stigmas 2, divergent; ovule solitary, pendulous from or near apex, anatropous. *Fruit* thinly fleshy; endocarp hard. *Seeds* without endosperm; embryo curved.

Characters not applicable in South Africa except in cultivated species (*Ulmus*; see appendix): sepals sometimes 6–8; stamens rarely more than calyx lobes; ovary 2-locular; fruit compressed, dry and ± winged; embryo straight.

Genera 14, with about 120 species, mainly tropical and North Temperate, only four genera represented in Africa, three in southern Africa together with one commonly cultivated.

1a Plant with axillary spines; stipules united along one margin ..... *Chaetacme*
1b Plant unarmed (in African species); stipules free:
  2a Ovary stipitate, compressed; fruit a flat samara, wing surrounding fruit; embryo straight (cultivated) ..... *Ulmus*
  2b Ovary sessile; fruit a thinly fleshy drupe; embryo curved:
    3a Male flowers with induplicate-valvate calyx lobes; leaves serrate almost from base; stigmas 0.5–1.0 (–2.0) mm long ..... *Trema*
    3b Male flowers with imbricate calyx lobes; leaves entire, coarsely toothed or serrate but then only in upper $^2/_3$; stigmas 2–5 mm long ..... *Celtis*

1906000 CHAETACME

Chaetacme *Planch.* in Annales des sciences naturelle, Sér. 3, 10: 266, 340 (1848); E.Phillips: 246 (1951); Polhill: 144 (1964); Polhill: 12 (1966); J.H.Ross: 149 (1972); Palmer & Pitman: 433 (1972); R.A.Dyer: 35 (1975); Wilmot-Dear: 1 (1991); Todzia: 610 (1993). Type: *C. aristata* Planch.

Trees or shrubs, monoecious, rarely dioecious; bark smooth, grey, later fibrous, longitudinally striate; branches with axillary spines. *Leaves* penninerved with lateral veins looping near margin, shortly petiolate, long-mucronate, slightly unequal-sided at base; stipules relatively large, amplexicaul and connate, tightly enclosing terminal bud, caducous leaving annular scars. *Inflorescences* cymose, often branched, usually congested, entirely male or with 1(–2) females near base; female flowers otherwise solitary, usually in upper axils. *Flowers* subtended by small broadly ovate bracts; male with pistillode; female without staminodes. *Tepals* 5, shortly basally united, in male buds induplicate-valvate, in female imbricate. *Anthers* oblong. *Ovary* sessile; stigmas long, persistent, divaricate. *Fruits* large, endocarp very hard.

A genus of one species, confined to Africa and Madagascar.

Chaetacme aristata *Planch.* in Annales des sciences naturelles, Sér. 3, 10: 341 (1848); Engl.: 160 (1895); Sim: 305, t. 160 (1907); Engl.: 15, t. 8 (1915); N.E.Br.: 521 (1925); Burtt Davy: 437 (1932); Henkel: 57, 79 (1934); Brenan: 625 (1949); Codd: 19 (1951); Eggeling: 436 (1952); Andrews: 254, t. 88 (1952); Keay: 593 (1958); Dale & Greenway: 576 (1961); White: 22 (1962); F.von Breitenbach: 84 (1965); Compton: 105 (1966); Letouzey: 56, t. (1968); P.van Wyk: 39, t. (1972); Compton: 173 (1976); Coates Palgrave: 98 (1977); Pooley: 66, t. (1993). Type: Cape Province, *Drège s.n.* (K, isolecto.!).

Chaetacme nitida Planch. & Harv.: 16, t. 25 (1859). *C. aristata* Planch. var. *nitida* (Planch. & Harv.) Engl.: 15 (1915). Types: South Africa, Cape Province, Galgebosch, *Drège s.n.* (TCD, lecto.; K, isolecto.!).

C. madagascariensis Baker: 443 (1885). Type: Madagascar, *Baron 2397* (K, holo.!).

C. aristata Planch. var. *kamerunensis* Engl.: 24 (1900); Engl.: 15 (1915). Types: Cameroun, *Zenker & Staudt 430* (B, syn.); Zaire, *Pogge 692* (B, syn.).

C. serrata Engl.: 24 (1900). Types: Tanzania, Usambara Mts, *Holst 505* (B, syn.); South Africa, Cape Province, *Beyrich 119* (B, syn.); *Bachmann 432, 433* (B, syn.).

C. aristata Planch. var. *longifolia* De Wild. & T.Durand: 214 (1901). Types: Zaire, *Dewevre 903, 965* (BR, syns.).

Bosqueia spinosa Engl.: 548 (1908). Type: Tanzania, Ukerewe Is., *Uhlig V73* (B, holo., K, photo.!).

C. microcarpa Rendle: 13 (1916); Rendle: 423 (1928); Peter: 61 (1932); Battiscombe: 85 (1936); Eggeling: 247 (1940); Hauman: 51 (1948). Type: Sudan Republic, Bahr el Ghizal, *Schweinfurth 2828* (K, isolecto.!).

C. microcarpa Rendle var. *crenata* Hutch. & Dalz.: 423 (1928). Type: Ivory Coast, *Chevalier 21824* (K, holo.!).

Scrambling shrub to small, much-branched tree, 1–13 m tall, branches ± drooping, zigzag; twigs shortly spreading-pubescent to glabrous, often short and becoming spinose at apex; axillary spines single(–paired), 4–30 mm long. *Leaves* elliptic to elliptic-ovate, (20–)30–90(–110) × (10–)15–45 mm, apex acute to shortly acuminate, terminal point up to 7 mm long, base broadly cuneate to rounded (to slightly cordate), margin entire or with occasional irregularly-disposed (or many, regular, especially juvenile plants) mucronate teeth; midrib prominent beneath, lateral veins ± 10, indistinct, coriaceous (juvenile foliage sometimes membraneous-charta-

* The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, England.

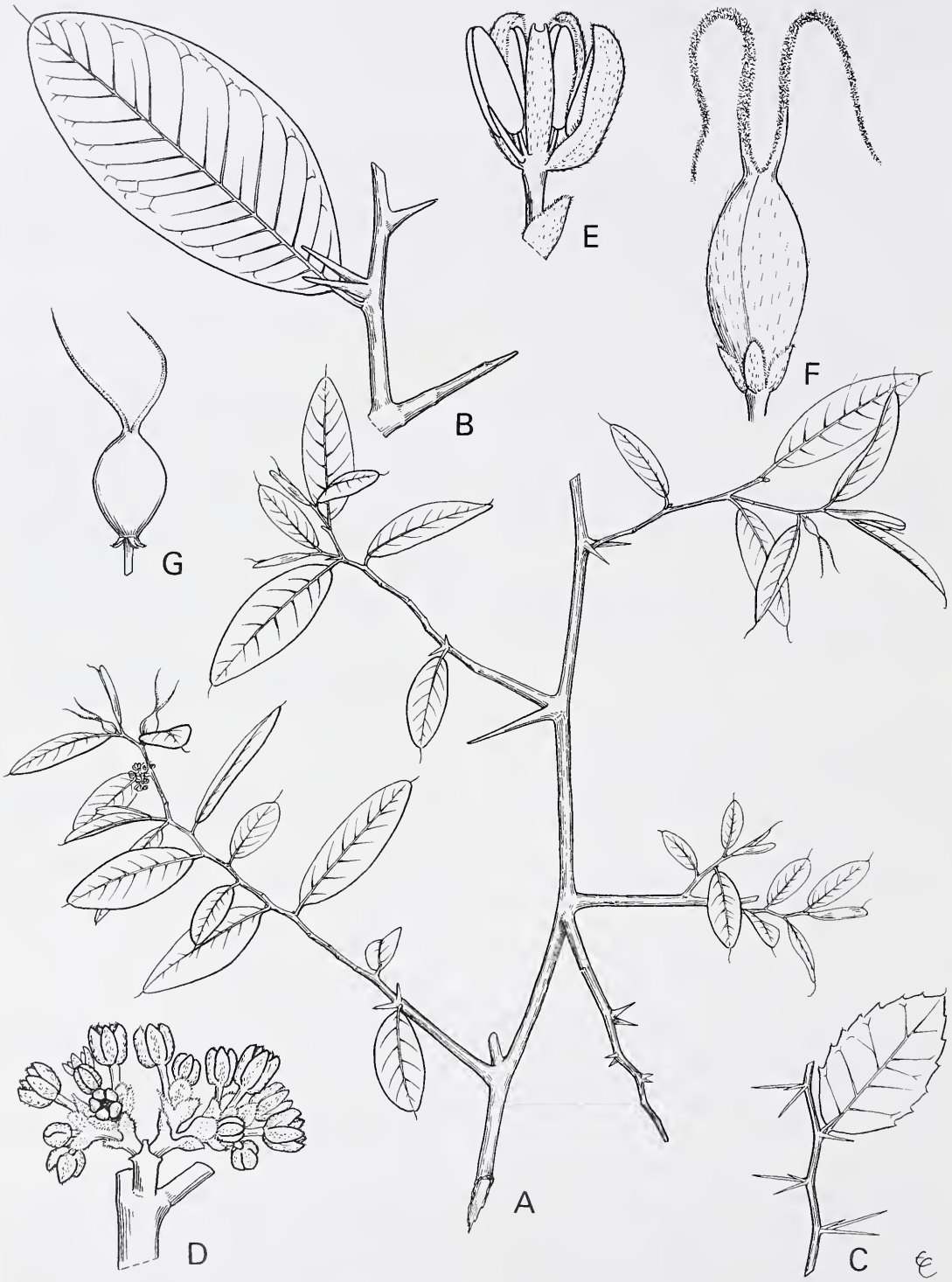

FIGURE 1.—*Chaetacme aristata*. A, branches showing flowers and fruits, × 0.8. B, C, portions of twigs: B, × 1.6; C, × 0.8. D, cyme of male flowers, × 4.6; E, male flower, 2 tepals and 1 stamen removed, × 9.4; F, female flower, × 9.4; G, mature fruit, × 2.4. A, *Acocks 12540*; B, *Van der Schijff 2456*; C, *Vahrmeijer 574*; D, *Gordon-Gray 1726*; E, F, *Acocks 9455*; G, *Strey 7364*. Artist: Eleanor Catherine.

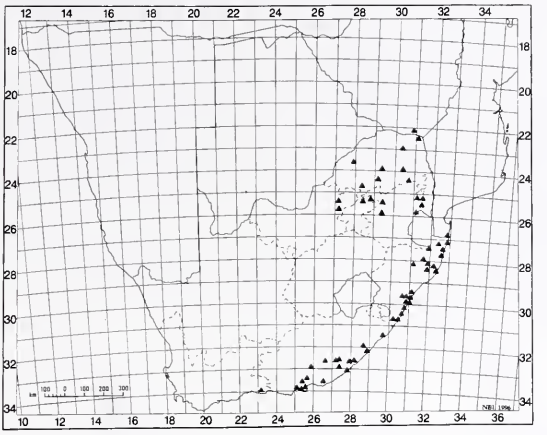

FIGURE 2.—Distribution of *Chaetacme aristata* in southern Africa.

ceous), glabrous, very glossy above, often scabrid or sparsely fine-pubescent below and on midrib; petiole 3–6 mm long; stipules narrowly oblong-lanceolate, (6–)10–20 mm long. *Stipules* (5–)10–20 mm long, narrowly oblong-lanceolate. *Inflorescences* 5–15 mm; flowers greenish cream-coloured, males (few–)10–over 30; pedicels 1–3 mm long. *Tepals* finely pubescent, male 2.0–3.5 × 1.5–2.0 mm, female 1.0–2.0 × 1.0–1.5 mm. *Ovary* sparsely fine-pubescent, 3–5 mm long; stigmas 7–12(–30) mm long. *Fruit* green, ripening yellowish orange, ovoid or depressed-globose, 10–15 × 10–14 mm (dried), to 35 × 20 mm (fresh), glabrous. Figure 1.

Found in the Northern Province, North-West, Mpumalanga, Swaziland, throughout the coastal region from northern KwaZulu-Natal, Eastern Cape as far south as Knysna in Western Cape (Figure 2); from Sudan, eastern Africa and Zaïre to West Africa, and in Madagascar. Occurs in riverine and coastal forest, lowland and upland rainforest, wooded grassland, sand dunes; found especially in disturbed and cleared areas.

Distinctive in its axillary spines and long-mucronate glossy leaves.

Vouchers: *Guy 109* (PRE); *Moll 2155* (NU, PRE); *Netshiungani 758* (NH, PRE); *Pott (5699) 16731* (NH, PRE); *Scott-Smith & Ward 8* (NH, PRE).

1902000 TREMA

Trema *Lour.*, Flora cochinchinensis: 562 (1790); E.Phillips: 246 (1951); Palmer & Pitman: 429 (1972); J.H.Ross: 148 (1972); R.A.Dyer: 32 (1975); Polhill: 143 (1964); Polhill: 10 (1966); Polhill: 268 (1989); Wilmot-Dear: 3 (1991); Todzia: 610 (1993). Type: *T. cannabina* Lour.

Trees or shrubs, monoecious(–dioecious). *Leaves* alternate, penninerved, petiolate, unequal-sided at base, serrate; stipules lateral, free, relatively small, caducous. *Inflorescences* axillary, cymose, often branched, usually congested, mainly male with female and bisexual flowers fewer and towards apex. *Tepals* (4–)5, shortly united at base, in male buds induplicate-valvate, in female imbricate. *Anthers* oblong-ovate. *Ovary* sessile; stigmas short, divaricate or inrolled, persistent. *Fruits* small.

A genus of ± 15 species in the tropics and subtropics, only one present in Africa.

Trema orientalis (*L.*) *Blume*, Museum Botanicum Lugduno–Batavum 2: 62 (1856); Leroy: 10 (1952); Compton: 105 (1966); Schreiber: 1 (1967); Letouzey: 48, t. (1968); P.van Wyk: 42, t. (1972); Compton: 173 (1976); Coates Palgrave: 98 (1977); Pooley: 66, t. (1993). Types: Sri Lanka, Herb. Hermann folio 2: 1 & 4: 71 (BM-SL, syn.).

Celtis orientalis L.: 1044 (1753). *Sponia orientalis* (L.) Planch: 320 (1848).

C. guineensis Schumach. & Thonn.: 160 (1827). *Sponia guineensis* (Schumach. & Thonn.) Planch.: 197 (1873). *Trema guineensis* (Schumach. & Thonn.) Ficalho: 261 (1884); Engl.: 160 (1895); Engl.: 14, t. 7 (1915); Rendle: 11 (1916); Burtt-Davy: 436, t. 67 (1932); Peter: 62 (1932); Henkel: 107 (1934); Hauman: 48, t. 8 (1948); Robyns: 46, t. 4 (1948); Brenan: 625 (1949); Williams: 475, t. (1949); Eggeling: 438 (1952); Andrews: 256, t. 89 (1952); Brenan: 76 (1954); Brenan: 592 (1958); Dale & Greenway: 577 (1961); White: 24 (1962); F.von Breitenbach: 81, t. 2, 83 (1965). Type: Ghana, *Thonning s.n.* (C, iso.).

C. guineensis Schumach. & Thonn. var. *parvifolia* Schumach. & Thonn.: 161 (1827). *T. guineensis* (Schumach. & Thonn.) Ficalho var. *parvifolia* (Schumach. & Thonn.) Engl.: 14 (1915). Type: Ghana, *Thonning s.n.* (C. iso.).

Sponia bracteolata Hochst.: 87 (1845). *T. bracteolata* (Hochst.) Blume: 58 (1856); Sim: 305, t. 158 (1907); N.E.Br.: 519 (1925). Type: KwaZulu-Natal, 'in clivitiis montium Tafelburge terrae Natalensis', Dec. 1839, *Krauss 41* (B, holo. †; BM, K, iso.!).

S. glomerata Hochst.: 87 (1845). *T. glomerata* (Hochst.) Blume: 58 (1856). Type: KwaZulu-Natal: 'in silvis primitivis terrae Natalensis', Oct. 1839, *Krauss 343* (B, holo. †; K, iso.!).

S. africana Planch.: 320 (1848). *T. africana* (Planch.) Blume: 58 (1856). Types: Senegal, *Heudelot 50* (K, syn.!); Sierra Leone, *Vogel 138* (K, syn.!).

S. nitens Planch.: 325 (1848). *T. nitens* (Planch.) Blume: 58 (1856). Type: Fernando Po: 'secus oram Africae occident, haud longe a littore maris', 1848, *Vogel 47 in herb Hook.* (K, holo.! & iso.!).

S. strigosa Planch.: 320 (1848). *T. strigosa* (Planch.) Blume: 58 (1856). Type: Nigeria, *Vogel 33* (K, holo.!).

S. hochstetteri Planch.: 198 (1873). *T. guineensis* (Schumach. & Thonn.) Ficalho var. *hochstetteri* (Planch.) Engl.: 160 (1895); Engl.: 14 (1915); Rendle: 12 (1916); Peter: 63 (1932). Type: Ethiopia, Gojjam, *Schimper 195* (K, isolecto.!).

T. guineensis (Schumach. & Thonn.) Ficalho var. *paucinervia* Hauman: 412 (1942); Hauman: 48 (1948). Type: Zaïre, Ubangi-Uele, Bossobolo, *Leontovitch 93* (BR, holo.). See note in Polhill: 10 (1966).

Shrub or small to medium tree 12(–18) m tall, branches ± spreading or drooping; bark smooth, grey, becoming longitudinally fissured; lenticels conspicuous; twigs densely(–sparsely) pubescent. *Leaves* ovate-attenuate to ovate-lanceolate(–lanceolate-oblong), (45–)60–110(–150, juvenile) × (15–)22–50(–90, juvenile) mm, apex acute, base rounded to cordate, evenly closely serrate except extreme base; midrib and lateral veins compressed above, prominent below; ± scabrid, sparsely stiff-hairy(–glabrescent) above, densely pubescent-tomentose below; petiole 8–10(–13) mm; stipules lanceolate, pubescent, 4–7 mm. *Cymes* 5–10 mm; flowers greenish cream-coloured, males (few–)many, females and bisexual

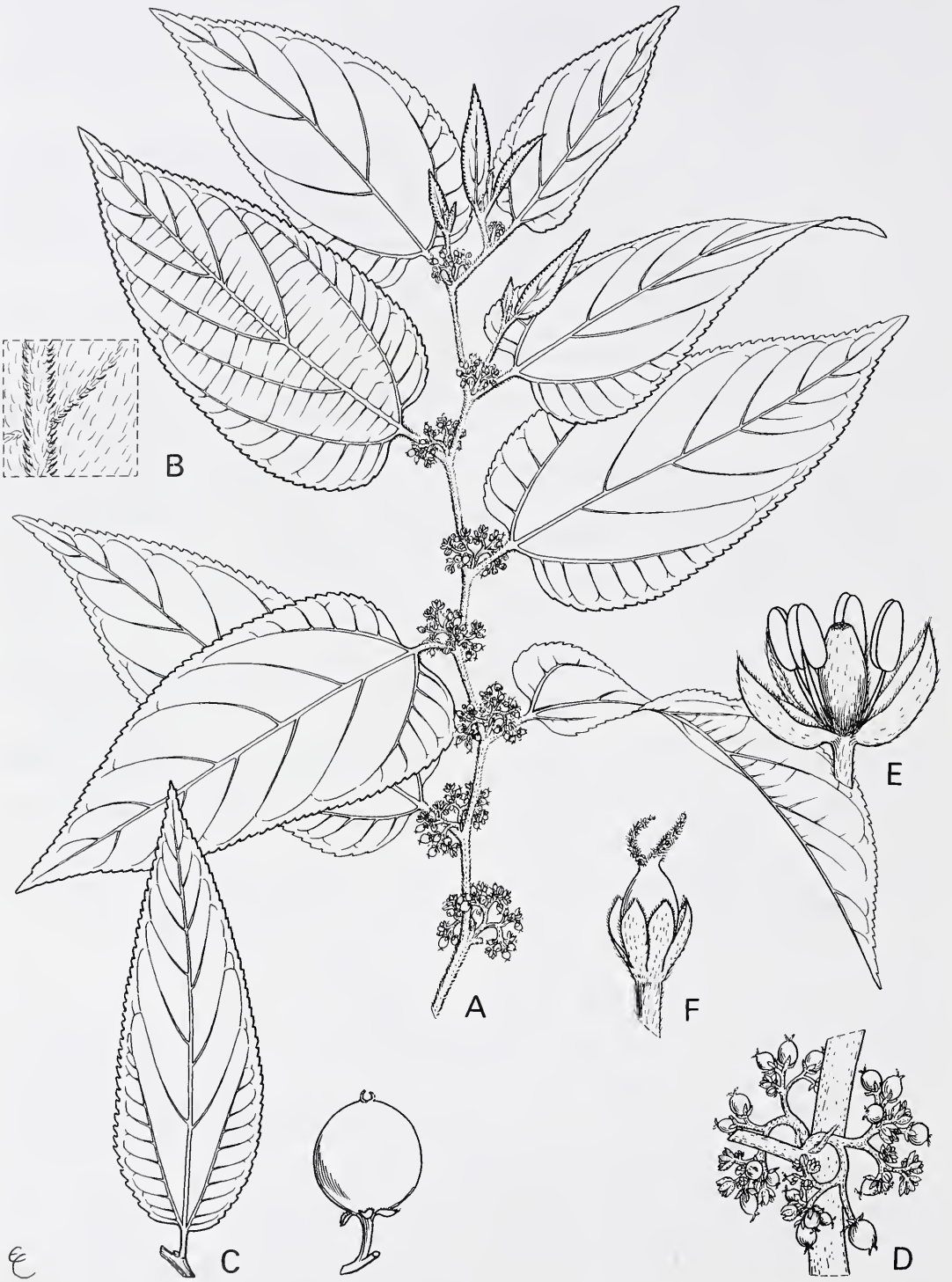

FIGURE 3.—*Trema orientalis*. A, branch with inflorescences and young fruit, × 0.8; B, detail of leaf, lower surface, × 12; C, leaf, × 0.8; D, inflorescence, × 2.4; E, male flower, 1 tepal and 1 stamen removed, × 9.6; F, female flower, × 9.6; G, fruit, × 4.8. A, B, D, F, *Merxmüller & Giess 30725*; C, *Hanaface 1347*; E, *Pearson 9826*; F, *Gerrard 14*. Artist: Eleanor Catherine.

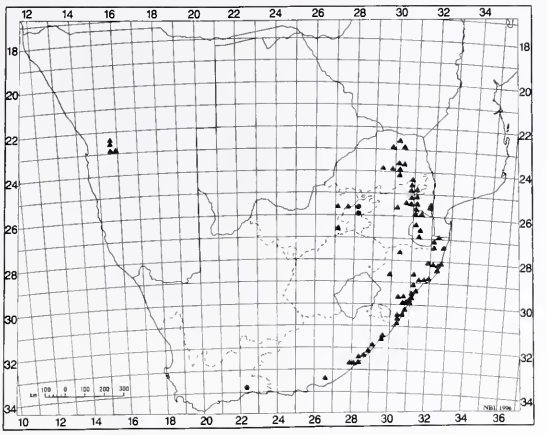

FIGURE 4.—Distribution of *Trema orientalis*, ▲; *Ulmus*, cultivated, ●, in southern Africa.

few(–more than male); subtending bracts triangular, ± 1 mm; pedicels short or absent. *Tepals* 1.0–1.5(–2.0) × ± 0.5 mm. *Ovary* pubescent, 1.0–1.5 mm; stigmas 0.5–1.2 mm. *Fruit* purple or black. ovoid-globose, (2.0–)3.5 (–4.0) mm (dried), glabrous. Figure 3.

Found in western Namibia (Karibib), Northern Province, North-West, Gauteng, Mpumalanga (especially eastern parts), Swaziland, KwaZulu-Natal (mainly coastal half) and in coastal parts of Eastern Cape to Grahamstown (Figure 4). Occurs also throughout other regions of Africa south of the Sahara, in Madagascar, Mascarene Islands and tropical Asia. Found in a wide range of habitats, especially in moist soil: in or on margins of lowland and upland rainforest, riverine forest, dry sandy river beds; a common pioneer of disturbed and cleared ground; 0–2 000 m.

Planted for soil reclamation; a good timber tree.

Vouchers: *Edwards & Wells 140* (PRE); *Jensen 497* (PRE); *Kluge 1846* (PRE); *Pole Evans H16850* (PRE); *Simon & Leach 2257* (PRE).

1808000 CELTIS

Celtis *L.*, Species plantarum 1: 1043 (1753); L.: 467 (1754); E.Phillips: 246 (1951); Polhill: 139 (1964); Polhill: 3 (1966); Palmer & Pitman.: 422 (1972); J.H.Ross: 148 (1972); R.A.Dyer: 32 (1975); Polhill: 266 (1989); Wilmot-Dear: 6 (1991); Todzia: 609 (1993). Type: *C. australis* L.

Trees or shrubs, monoecious, rarely dioecious. *Leaves* petiolate, usually unequal-sided at base, penninerved or 3-veined from base; cystoliths often present giving rough texture; stipules lateral, free, relatively small. *Flowers* often precocious, usually in many small cymes; female sometimes on separate inflorescence. *Tepals* (4–)5, ± free, imbricate. *Anthers* ovate. *Ovary* sessile; stigmas often furcate or twice-furcate. *Fruit* drupaceous, sometimes with ribbed endocarp.

Characters not present in South Africa: axillary spines sometimes present; inflorescence sometimes fasciculate.

A genus of over 50 species, widespread in tropical and temperate regions, less than ten present in Africa, three in southern Africa.

1a Leaves with basal lateral veins extending well into upper half of blade; main lateral veins 1 or 2 on each side of midrib; margin usually conspicuously serrate in upper $^2/_3$; fruit subglobose, 2-angled when dry . . . . . 1. *C. africana*

1b Leaves with basal lateral veins not or little extending into upper half of blade; main lateral veins (2–)3–6 each side of midrib; margin entire or obscurely crenate to coarsely dentate in upper half only; fruit usually ellipsoid-ovoid or conical-ovoid, 4-ribbed when dry:

2a Stigmas unbranched; stem pubescence (when present) whitish; fruit conical-ovoid, 5–6(–7) mm long; leaves entire, acumen long, ($^1/_8$–)usually $^1/_4$–$^1/_3$ of whole blade length; upper lateral veins usually ± as thickly prominent as midrib beneath and making sharp angle of less than 45° with midrib . . . . . 2. *C. gomphophylla*

2b Stigmas branched once or twice; stem pubescence (when present) tawny; fruit ovoid-ellipsoid, 7–10 mm long; leaves usually ± crenate in upper $^1/_2$; acumen short, up to $^1/_7$(–$^1/_5$) whole blade length; upper lateral veins markedly more finely prominent than midrib beneath and making less sharp angle, greater than 45°, with midrib . . . . . 3. *C. mildbraedii*

1. **Celtis africana** *Burm.f.*, Flora indica: nec non prodromus florae capensis: 31 (1768); Rendle: 3 (1916); Hauman: 43 (1948); I.Verd.: t. 1210 (1956); Keay: 592 (1958); Dale & Greenway: 574, t. 104 (1961); Letty: 109, t. 54, 2 (1962); White: 22 (1962); F.von Breitenbach: 79, 81, t. (1965); Letouzey: 14, t. (1968); Jacot Guill.: 161 (1971); P.van Wyk: 40, t. (1972); Coates Palgrave: 98 (1977); Pooley: 64, t. (1993). Type: t. 88 in Burm., Rariorum africanarum plantarum: 242 (1739).

C. rhamnifolia C.Presl: 37 (1844) nom. nud.; N.E.Br.: 518 (1925).

C. kraussiana Bernh.: 87 (1845); Sim: 306 pl. 134 (1907); Engl.: 12 (1915); Rendle: 3 (1916); Burtt-Davy: 435, t. 66 (1932); Peter: 64 (1932); Henkel: 106 (1934); Battiscombe: 84 (1936); Hauman: 43 (1948); Robyns: 43 (1948); Brenan: 624 (1949); Adamson: 315 (1950); Codd: 18 (1951): Eggeling, 434, t. 89b (1952); Andrews: 253 (1952); Cufod.: 5 (1953). Type: Cape Province, Tafelberg, *Krauss 1776* (B, holo. †; G, iso.; K, photo. of iso.!).

C. eriantha E.Mey. ex Planch.: 296 (1848). Types: South Africa, Cape Province, 'prope Graaf reinet, in montosis scopulosis 3000–4000 ft.', *Drège s.n.* (K, syn.!); Orange River, *Burke s.n. in Herb. Hook.* (K, syn.!; BM, isosyn.!).

C. burmannii Planch.: 296 (1848), excl. syn. Type: South Africa, Cape Province, 'Oudeberg; juxta montes Snewbergen alt. 3000–4000 ped.', *Drège s.n.* (K, isolecto.!).

C. opegrapha Planch.: 294 (1848). Type: South Africa, Cape Province, 'prope Gaatje', *Drège 8261b* (K, isolecto.!).

C. holtzii Engl.: 12, t. 6E (1915). Type: Tanzania, Mwanza, *Holtz 1591* (B, holo.; K, photo. of holo.!).

C. kraussiana Bernh. var. *stolzii* Peter: 64 (1932); Brenan: 624 (1949). Type. Tanzania, Rungwe Dist., *Stolz 1708* (B, holo.; BM, K, iso.!).

C. australis auct.: A.Rich.: 257 (1851); non L.

C. rhamnifolia auct.: N.E.Br.: 518 (1920); non Presl.

Deciduous shrub or ± spreading tree, 2–30 m tall; bark smooth, whitish grey, often pinkish blotched; fresh-

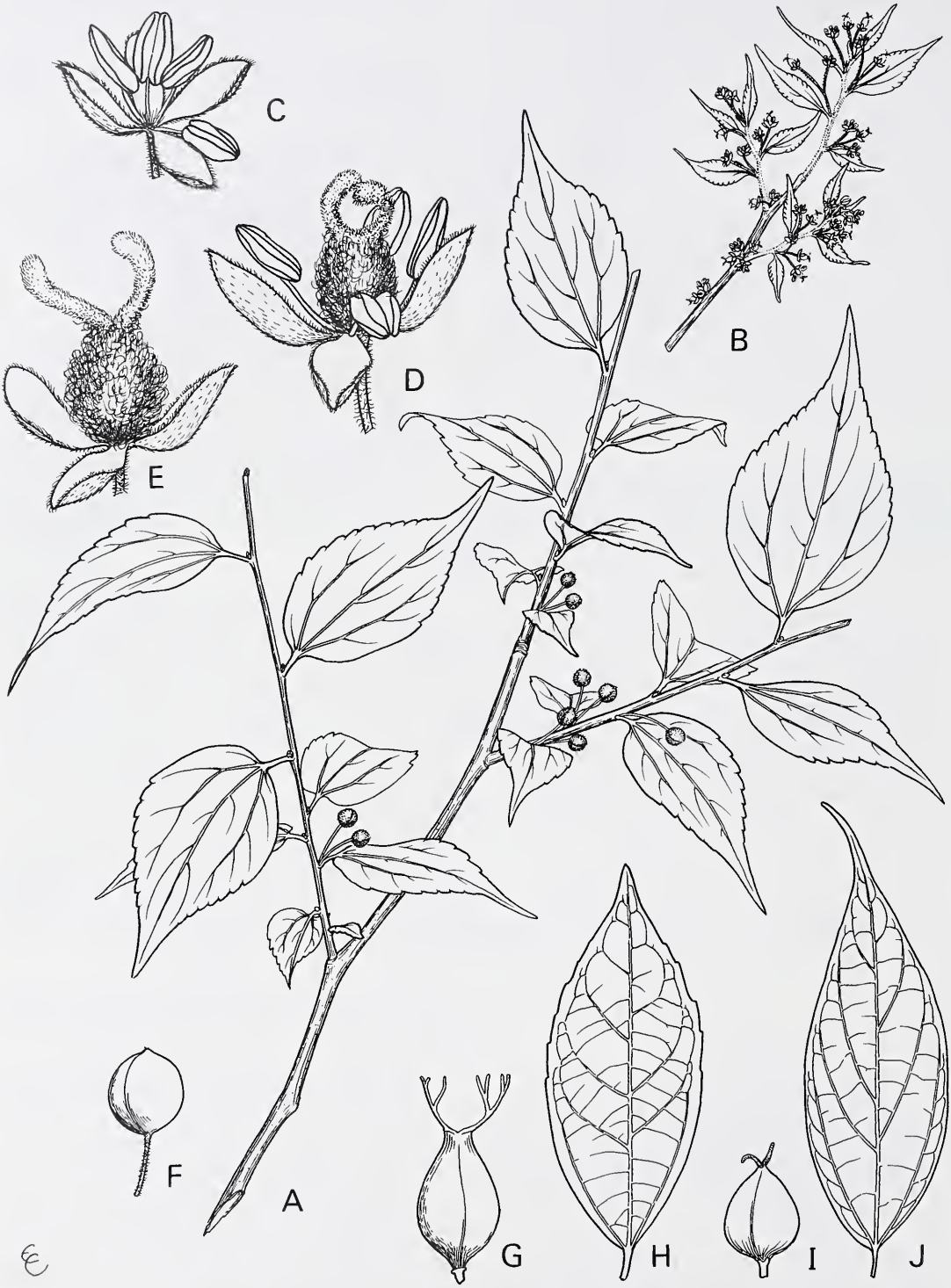

FIGURE 5.—*Celtis*. A–F, *C. africana*: A, fruiting branch, × 0.8; B, flowering branch, × 0.4; C, male flower, × 9.4; D, bisexual flower, × 9.4; E, female flower, × 9.4; F, fruit, × 2.4. G, H, *C. mildbraedii*: G, fruit, × 2.4; H, leaf, × 0.8. I, J, *C. gomphophylla*: I, fruit, × 2.4; J, leaf, × 0.8. A, B, *Bolus 685*; C, D, *Galpin 11529*; E, *Strey 8921*; F, *Rodin 3899*; G, H, *Ward 7631*; I, *Strey 8785*; J, *Ward 5905*. Artist: Eleanor Catherine.

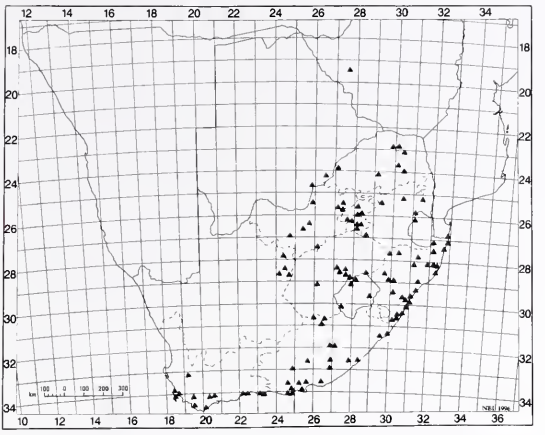

FIGURE 6.—Distribution of *Celtis africana* in southern Africa.

ly-cut wood unpleasant-smelling; young twigs densely tawny-pubescent-tomentose. *Leaves* broadly or narrowly ovate to ovate-lanceolate, 30–90(–130, juvenile) × 25–55(–70, juvenile) mm, acuminate, base rounded to cuneate, margin (± entire to coarsely crenate-)dentate-serrate in upper $^2/_3$; basal lateral veins extending well into upper half, upper lateral veins 1 or 2 each side; thinly or thickly chartaceous, often rough, young foliage often densely tawny-pubescent both sides, but glabrescent except veins below; petiole 2.5–5.0(–10.0) mm; stipules linear to linear-obovate, 3–8 mm, pubescent. *Inflorescences*: lower cymes numerous, of (3–)many male flowers; pedicels 1.5–5.0 mm; uppermost inflorescences of 1–few bisexual flowers; pedicels to 12 mm, intermediate of both male and bisexual; axis and pedicels usually densely tawny-pubescent. *Tepals* 1.5–2.5 mm, pubescent. *Ovary* densely pubescent; stigmas unbranched, 1.5–3.5 mm. *Fruits* orange(–blackish), subglobose (–ovoid-ellipsoid) (4–)5–7(–8) × 3–6 mm (dried), pubescent, pedicel to 18 mm. Figure 5A–F.

Found in southwestern and southeastern Botswana (Ukwi, Mochudi; few collections), throughout Northern Province, North-West, Mpumalanga and Gauteng and extreme south, throughout Swaziland, Free State, KwaZulu-Natal, Lesotho, most northeastern parts of Northern Cape, Eastern Cape and along major rivers and in coastal areas of Western Cape excluding the west coast north of Cape Town (Figure 6); widespread from Arabia to Cape, Sudan to Nigeria and Angola. Occurs in a wide range of habitats: dry evergreen and riverine forests, upland rainforest, coastal forest; found from coast up to 2 000 m.

A useful street tree; also yields hard timber.

Vouchers: *Acocks 1616* (PRE); *Brueckner 1218* (K, PRE); *Flanagan 279* (K, PRE); *Moll 4455* (NH, PRE); *Ward 7701* (K, NH, NU, PRE).

2. **Celtis gomphophylla** *Baker* in Journal of the Linnean Society of London, Botany 22: 521 (1887); Leroy: 6, t. 3 (5–8) (1952); Letouzey: 39, t. (1968); Coates Palgrave: 97 (1977). Type: Madagascar, *Baron 3697* (K, holo.!).

C. durandii Engl.: 22 (1900); Engl.: 179 (1911); Engl.: 12, t. 6D (1915); Rendle: 4 (1916); Peter: 65 (1932); Hauman: 42 (1948); Robyns: 43 (1948); Brenan: 624 (1949); Keay: 592 (1958); White: 431 (1962); Polhill: 140 (1964); Polhill: 5 (1966); Palmer & Pitman: 427 (1972); Pooley: 64, t. (1993). Types: Tanzania, Usagara, *Von Trotha 171* (B, syn.; K, photo. of syn.!); Zaïre, Bas-Congo, *Dupuis* (B, syn.; BR isosyn.; K, photo. of syn.!).

C. ugandensis Rendle: 341 (1906). *C. durandii* Engl. var. *ugandensis* (Rendle) Rendle: 5 (1916); Battiscombe: 84 (1936); Hauman: 43 (1948); Robyns: 43 (1948); Eggeling: 432 (1952); Dale & Greenway: 574 (1961). Type: Uganda, Entebbe, *Bagshaw 669* (BM, holo.!).

C. dioica S.Moore: 204 (1911). Type: Zimbabwe, Chirinda Forest, *Swynnerton 108* (BM, holo.!; K!).

Deciduous monoecious(–dioecious) tree, 3–30 m tall; bark smooth, light grey, wood unpleasant-smelling; young twigs whitish pubescent. *Leaves* ovate-elliptic (–oblong-elliptic), (50–)60–150 × 20–50 mm, long-acuminate, base cuneate to rounded, margin entire, (juvenile foliage of very different appearance, to 210 × 90 mm, upper half of margin coarsely dentate); basal lateral veins extending little into upper half, upper lateral veins (2)3–6 each side, as thickly prominent beneath as midrib, usually making an acute angle of less than 45° with midrib; membraneous-chartaceous, usually thin, glabrescent, often scabrid; petiole 4–8 mm; stipules linear to linear-oblong, 2–6 mm, pubescent. *Cymes* of male flowers numerous, (few–)many-flowered, pedicels 3–7 mm, female and bisexual flowers few or solitary, pedicels often longer. *Tepals* 1.2–2.0 mm, pubescent. *Ovary* ± pubescent; stigmas unbranched, 2.0–2.5 mm. *Fruits* dark yellowish, conical-ovoid, often 4-angled when dry, 4–6(–7) × 3–5 mm, glabrous; pedicel 3–10 mm. Figure 5I, J.

Found in coastal regions of KwaZulu-Natal and of Eastern Cape south to Umtata (Figure 7); also in western Mozambique, eastern Zimbabwe and Zambia and from Zaïre and Angola to Nigeria and San Tomé. Occurs in lowland and upland rain forest and riverine forest.

Vouchers: *Moll 3359* (K, PRE), *5636* (K, NH); *Tinley 450* (K, PRE); *Ward 2998* (K, PRE); *White 10431* (NH).

3. **Celtis mildbraedii** *Engl.* in Botanische Jahrbücher 43: 309 (1909); Engl.: 180, t. 16E (1911); Engl.:

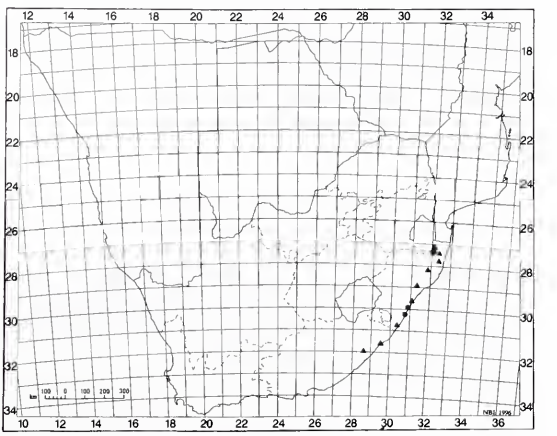

FIGURE 7.—Distribution of *Celtis gomphophylla*, ▲; and *C. mildbraedii*, ●, in South Africa.

14 (1915); Hauman: 45 (1948); Keay: 592 (1958); Dale & Greenway: 576 (1961); Letouzey: 33, t. (1968); Coates Palgrave: 97 (1977); Pooley: 66, t. (1993). Type: Zaïre orientale, *Mildbraed 2897* (B, lecto.; K, photo. of lecto.!).

C. soyauxii sensu Engl.: 23 (1900) pro parte; Rendle: 5 (1916); Battiscombe: 84 (1936); Brenan: 624 (1949); Eggeling: 435, t. 89c, photo. 55 (1952); Andrews: 251 (1952); non Engl. sensu stricto.

C. usambarensis Engl.: 309 (1909); Engl.: 14 (1915); Peter: 65 (1932). Type: Tanzania, E Usambara Mts, *Zimmermann in Herb. Amani 831* (B, holo.; K, photo. of holo.!).

C. franksiae N.E.Br.: 517 (1925); Henkel: 106 (1934); F.von Breitenbach: 82 (1965). Type: South Africa, KwaZulu-Natal, near Durban, 12 Dec. 1910, *Franks s.n. in Herb. Wood 11726* (K, holo.! BOL, NBG, SAM, iso.!).

Evergreen or deciduous monoecious tree, 3–40 m tall, buttressed, branches often drooping; bark pale, smooth or scaling in discs; young twigs tawny-pubescent. *Leaves* elliptic to elliptic-obovate, (75–)90–150 × 40–50 mm, acuminate ± mucronate, base cuneate, (± entire-) obscurely crenate to coarsely dentate in upper half; chartaceous to thinly coriaceous, venation as in *C. gomphophylla* but upper lateral veins markedly less thickly prominent beneath than midrib and making more obtuse angle of over 45° with midrib; pubescent, soon glabrescent except veins beneath; petiole 3–9 mm; stipules lanceolate, 4–5 mm., pubescent. *Cymes* 4–15 mm, of (few–)many often crowded male flowers, pedicels to 2 mm, female and bisexual flowers 1–few at apex, uppermost cymes with several bisexual flowers. *Tepals* 1.5–2.0 mm, pubescent. *Ovary* hairy at base; stigmas 1 or 2 times branched, ± 5 mm. *Fruits* red, ovoid-ellipsoid, 4-ribbed when dry, 7–10 × 5–6 mm, glabrous; pedicels 3–13 mm. Figure 5G, H.

Found in KwaZulu-Natal in north (Ubombo) and southeast (Stanger to Port Shepstone) (Figure 7), in Zimbabwe and Mozambique, from Sudan to Tanzania and from Zaïre to Angola and West Africa. Occurs in isolated patches of lowland rain forest; uncommon.

Vouchers: *Bayer 2* (BM, K, PRE); *Dohse 260* (BM, K, PRE); *Moll 3233* (K); *Ward 4817* (PRE), *5905* (K, NH, NU, PRE).

C. australis L., a Eurasian species closely related to *C. africana*, but with leaves usually serrate throughout length, grey-pubescent beneath and drying bright yellow-green above, fruits larger, (8–)10 × 9 mm, and *C. occidentalis* L. (N America), somewhat similar to *C. australis* but with bright green leaves glabrous beneath, have been cultivated in Pretoria.

Several species and hybrids of *Ulmus* L. have been cultivated as ornamentals: deciduous trees; bark fissured. *Leaves* serrate or biserrate. *Flowers* bisexual or hermaphrodite. *Perianth* herbaceous, cup-shaped, lobes 4–8, connate. *Stamens* of same number as perianth lobes. *Ovary* compressed, stipitate. *Fruit* a flat samara with encircling wing, emarginate at apex.

REFERENCES

ADAMSON, R.S. 1950. In R.S. Adamson & T.M. Salter, *Flora of the Cape Peninsula*: 315. Juta, Cape Town.

ANDREWS, F.W. 1952. *The flowering plants of the Anglo-Egyptian Sudan* 2: 250–256. Buncle, Arbroath.

BAKER, J.G. 1885. Flora of Madagascar. *Journal of the Linnean Society of London, Botany* 21: 407–455.

BAKER, J.G. 1887. Flora of Madagascar. *Journal of the Linnean Society of London, Botany* 22: 521.

BATTISCOMBE, E. 1936. *Trees and shrubs of Kenya Colony*. The Government Printer, Nairobi.

BERNHARDI, J.J. 1845. In Pflanzen des Cap- und Natal-Landes, gesammelt und zusammengestellt von Dr Ferdinand Krauss. *Flora* 28.

BLUME, C.L. 1856. *Museum botanicum Lugduno-Batavum, sive stirpim exoticarum novarum vel minus cognitarum* 2. Leiden.

BRENAN, J.P.M. 1949. *Check-lists of the forest trees and shrubs of the British Empire, Tanganyika territory* No. 5, 2. Imperial Forestry Institute, Oxford.

BRENAN, J.P.M. 1954. Plants collected by the Vernay Nyasaland Expedition of 1946. *Memoirs of the New York Botanical Garden* 9: 76.

BRENAN, J.P.M. 1958. Ulmaceae. In J. Hutchinson & J.M. Dalziel, *Flora of West tropical Africa*, edn 2, 1, 2: 591–593.

BROWN, N.E. 1925. Ulmaceae. In W.T. Thiselton-Dyer, *Flora capensis* 5,2: 516–521. Reeve, London.

BURMAN, J. 1739. *Rariorum africanarum plantarum* 9. Boussière, Amsterdam.

BURMAN, N.L. 1768. *Flora indica: nec non prodromus florae capensis*. Haak, Leiden.

BURTT DAVY, J. 1932. Ulmaceae. *A manual of the flowering plants and ferns of the Transvaal and Swaziland, South Africa* 2: 435–438. Longmans, Green, London.

COATES PALGRAVE, K. 1977. *Trees of southern Africa*. Struik, Cape Town.

CODD, L.E. 1951. Trees and shrubs of the Kruger National Park. *Memoirs of the Botanical Survey of South Africa* No. 26.

COMPTON, R.H. 1966. An annotated check list of the Flora of Swaziland. *Journal of South African Botany*, Suppl. Vol. 6.

COMPTON, R.H. 1976. The Flora of Swaziland. *Journal of South African Botany*, Suppl. Vol. 11.

CUFODONTIS, G. 1953. Ulmaceae. Enumeratio plantarum aethiopiae spermatophyta. *Bulletin du Jardin Botanique de l'État, Bruxelles*, Suppl. Vol. 23: 5–7.

DALE, I.R. & GREENWAY, P.J. 1961. Ulmaceae. *Kenya trees and shrubs*: 573–577. Hatchards, London.

DE WILDEMAN, E. & DURAND, T. 1901. Reliquiae Dewevreanae 1, 2. *Annales du Musée du Congo, Botanique*, Sér. 3.

DYER, R.A. 1975. *The genera of southern African flowering plants* 1. Department of Agricultural Technical Services, Pretoria.

EGGELING, W.J. 1940. Ulmaceae. *The indigenous trees of the Uganda Protectorate*, edn 1: 247. The Government Printer, Entebbe, Uganda.

EGGELING, W.J. 1952. Ulmaceae. *The indigenous trees of the Uganda Protectorate*, edn 2: 429–440. The Government Printer, Entebbe, Uganda.

ENGLER, A. 1895. *Die Pflanzenwelt Ost-Afrikas und der Nachbargebiete*, Theil C. Reimer, Berlin.

ENGLER, A. 1900. V. Diagnosen neuer Arten. *Notizblatt des Königlich botanischen Garten und Museum zu Berlin* 3: 21, 23, 24.

ENGLER, A. 1908. Moraceae africanae. IV. *Botanische Jahrbücher* 40: 548.

ENGLER, A. 1909. Neue Arten auf der zentral afrikanischen Expedition des Herzogs Adolf Friedrich zu Mecklenburg gesammelt von J. Mildbraed. *Botanische Jahrbücher* 43: 308, 309.

ENGLER, A. 1911. *Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907–1908*. Klinkhardt & Biermann, Leipzig.

ENGLER, A. 1915. In H.G.A. Engler & O. Drude, *Die Vegetation der Erde* IX, 3,1. Leipzig.

FICALHO, F.M.C. DE 1884. *Plantas uteis da Africa Portugueza*. Lisbon.

HAUMAN, L. 1942. Note sur les Ulmacées du Congo Belge. *Bulletin du Jardin Botanique del'État, Bruxelles* 16: 407–412.

HAUMAN, L. 1948. Ulmaceae. *Flore du Congo Belge et du Ruanda-Urundi* 1: 39–51.

HENKEL, J.S. 1934. *Woody plants of Natal and Zululand*. Robinson, Durban.

HOCHSTETTER, C.F.F. 1845. In F. Krauss, Pflanzen des Cap- und Natal-Landes. *Flora* 28, 6: 80–93.

HUTCHINSON, J. & DALZIEL, J.M. 1928. Ulmaccae. *Flora of West tropical Africa*, edn 1, Vol. 1: 421–423.

JACOT GUILLARMOD, A.F.M.G. 1971. *Flora of Lesotho*. Cramer, Lehre.
KEAY, R.W.J. 1958. Ulmaceae. *Flora of West tropical Africa*, edn 2, 1, 2: 591–593.
LEROY, J.-F. 1952. Ulmacées. In H. Humbert, *Flore de Madacascar et des Comores* 54: 1–15.
LETOUZEY, R. 1968. Ulmacées. *Flore du Cameroun* 8: 3–65.
LETTY, C. 1962. *Wild flowers of the Transvaal*. Trustees, Wild Flowers of the Transvaal Book Fund, Johannesburg.
LINNAEUS, C. 1753. *Species plantarum*, edn 1. Salvius, Stockholm.
LINNAEUS, C. 1754. *Genera plantarum*, edn 5. Salvius, Stockholm.
LOUREIRO, J. DE 1790. *Flora cochinchinensis*. Academy, London.
MOORE, S. LE M. 1911. Monochlamydeae. *Journal of the Linnean Society of London, Botany* 40: 204.
PALMER, E. & PITMAN, N. 1972. Ulmaceae. *Trees of southern Africa*, Vol. 1: 422–433. Balkema, Cape Town.
PETER, A. 1932. *Flora von Deutsch-Ostafrika* 2.
PHILLIPS, E.P. 1951. The genera of South African flowering plants, edn 2. *Memoirs of the Botanical Survey of South Africa* No. 25. Government Printer, Pretoria.
PLANCHON, J.E. 1848. Sur les Ulmacées et la famille des Urticacees. *Annales des sciences naturelle*, sér. 3, 10: 244–341. Paris.
PLANCHON, J.E. 1873. In A.P. de Candolle, *Prodromus systematis naturalis regni vegetabilis* 17: 151–210. Masson, Paris.
PLANCHON, J.E. & HARVEY, W.H. 1859. *Thesaurus capensis* 1. Hodges, Smith, Dublin.
POLHILL, R.M. 1964. Enumeration of the Ulmaceae in Africa south of the Sahara. *Kew Bulletin* 19: 139–145.
POLHILL, R.M. 1966. Ulmaceae. *Flora of tropical East Africa* 1966: 1–15.
POLHILL, R.M. 1989. Ulmaceae. *Flora of Ethiopia* 3: 266–269.
POOLEY, E. 1993. *The complete field guide to trees of Natal, Zululand and Transkei*. Natal Flora Publications Trust, Durban.
PRESL, C.B. 1844. *Botanische Bemerkungen*. Praha.
RENDLE, A.B. 1906. A new *Celtis* from tropical Africa. *Journal of Botany* 44: 341, 342.
RENDLE, A.B. 1916. Ulmaceae. *Flora of tropical Africa* 6,2: 1–14. Reeve, London.
RENDLE, A.B. 1928. Ulmaceae. In A.B. Rendle & M.B. Moss, *Flora of West tropical Africa* 1,1: 421–423.
RICHARD, A. 1851. *Tentamen flora abyssinicae* 2. Paris.
ROBYNS, W. 1948. Ulmaceae. *Flore des Spermatophytes du Parc National Albert* 1: 41–47.
ROSS, J.H. 1972. Flora of Natal. *Memoirs of the Botanical Survey of South Africa* No. 39.
SCHREIBER, A. 1967. Ulmaceae. *Prodromus einer Flora von Südwestafrika* 15: 1.
SCHUMACHER , H.C.F. & THONNING, P. 1827. *Beskrivelse af Guineiske planter som ere funde af danske botanikere, isaer af Etatsraad Thonning*. Copenhagen.
SIM, T.R. 1907. *The forest and forest flora of the colony of the Cape of Good Hope*. Taylor & Henderson, Aberdeen, London.
TODZIA, C.A. 1993. Ulmaceae. In K. Kubitski, J.G. Rohwer & V. Bittrich, *The families and genera of vascular plants—dicotyledons* 2: 603–611. Springer-Verlag, Berlin.
VAN WYK, P. 1972. Ulmaceae. *Trees of the Kruger National Park* 1: 39–43. Purnell, Johannesburg.
VERDOORN, I.C. 1956. *Celtis africana*. *The Flowering Plants of Africa* 31: t. 1210.
VON BREITENBACH, F. 1965. Ulmaceae. *The indigenous trees of southern Africa* 2: 78–85. The Government Printer, Pretoria.
WHITE, F. 1962. *Forest flora of northern Rhodesia*. Oxford University Press, London.
WHITE, F. 1964. *Celtis africana*. *Trees and shrubs of the Witwatersrand*. Witwatersrand University Press, Johannesburg.
WILLIAMS, R.O. 1949. *The useful and ornamental plants in Zanzibar and Pemba*: 475. Zanzibar.
WILMOT-DEAR, C.M. 1991. Ulmaceae. *Flora zambesiaca* 9, 6: 1–10.

Bothalia 29,2: 249–252 (1999)

FSA contributions 14: Cannabaceae

C.M. WILMOT-DEAR*

A family of two genera native to temperate parts of the Northern Hemisphere, one naturalised in Africa.

1973000 CANNABIS

Cannabis *L.*, Species plantarum 1: 1027 (1753); L.: 453 (1754); E.Phillips: 248 (1951), M.D.Hend. & J.G.Anderson: 70 (1966); N.G.Mill.: 188 (1970); J.H.Ross: 50 (1972); R.A.Dyer: 35 (1975); Stearn: 1, t. 1–7 (1970); Verdc.: 1 (1975); E.Small & Cronquist: 405 (1976); Emboden: 304 (1974); Emboden: 110 (1977); L.C.Anderson: 61 (1980); Wilmot-Dear: 10 (1991); Kubitzki: 204 (1993). Type: *C. sativa* L.

Erect, tall, annual aromatic herbs, dioecious, rarely monoecious; most parts of plant with minute adpressed swollen-based hairs. Male and female plants dimorphic; males taller and more slender with longer narrower leaflets, inflorescence sparsely leafy, plant dying soon after flowering; females shorter, more robust, inflorescence densely leafy, plant living several months after pollination. *Leaves* alternate (opposite at stem base), petiolate, palmately compound or lobed; indumentum a mixture of short robust bulbous-based hairs and longer finer hairs; leaflets uneven in size, serrate; stipules lateral, linear, acute, persistent. *Inflorescences* axillary. *Male inflorescences* much-branched, lax, cymose panicles, bristly-hairy, exceeding leaves but bearing few scattered leaves; flowers small, pedicellate, regular. *Perianth* uniseriate, lobes 5, free, imbricate, greenish or whitish, boat-shaped, spreading or reflexed. *Stamens* 5, opposite perianth lobes, erect in bud, pendulous at maturity, dehiscence longitudinal, basipetal; filaments short; pistillode absent. *Female inflorescences* short, compact, not exceeding leaves, few-flowered, flowers in pairs, each with stipule-like bract and small green organ ('bracteole' or 'calyx') completely enveloping ovary and loosely enclosing mature fruit, forming basally swollen tubular sheath, acuminate at apex and covered with fine hairs and short-stalked or sessile resinous glands. *Perianth* thin, undivided, tightly enveloping ovary and mature fruit (often reduced or absent in cultivated forms), marbled with light and dark areas. *Ovary* superior, sessile, ± globose, 1-locular with 1 pendulous anatropous ovule. *Style* short; stigma branches 2, long, filiform, densely pubescent, caducous. *Fruit* a globular to ovoid achene tightly covered by thin crustaceous perianth through which reticulate venation of fruit surface beneath is visible; achene with pale vein-reticulation patterning surface which is dark but somewhat translucent in outer layers. *Seed* 1, endosperm sparse, fleshy, oily; embryo strongly curved, cotyledons fleshy.

Easily identified by the light and dark patterning of the perianth layer (where this is present) surrounding the fruit, the reticulate venation of the fruit which, due to the translucence of the surface layers above and below, appears as if 'suspended in shallow water', and the mixture of short robust bulbous-based hairs and longer finer hairs.

A genus which has been treated variously as comprising three species (Emboden 1974; Anderson 1980), or one very variable species in which four forms can be recognised at varietal or subspecific level (Small & Cronquist 1976). Since female plants show a whole range of forms between extremes and since it is difficult or impossible to assign males to the various forms described, the genus seems best considered as comprising one species whose inherent variation has, by artificial selection for production of fibre, oil or intoxicating resin, followed by naturalisation, crossbreeding and recombination of characters, given rise to a reticulate pattern of variation where, primarily in the female, several extreme forms exist, but where a continuous range of intermediates is also present and where variation in males is far less extreme.

Used for fibre (hemp), oil and intoxicant resin.

Cannabis sativa *L.* Species plantarum 1: 1027 (1753); L.: 453 (1754); Engl.: 162 (1895); Engl.: 44 (1898); Hiern: 994 (1900); Rendle: 16 (1916); Burtt Davy: 445 (1932); Hauman: 176 (1948); Williams: 169 (1949); Adamson: 316 (1950); Andrews: 280 (1952); Trease: 216, t. 75 (1952); Cufod.: 17 (1953); Keay: 623 (1958); Schreiber: 290, t. 136, 137, fig. 88/1 (1958); Purseglove: 40, t. 4 (1968); Verdc. & Trump: 96 (1969); Jacot Guill.: 162 (1971); Stearn: 325 (1974); Verdc.: 1 (1975); Wilmot-Dear: 11 (1991). Type: female specimen in Hort. Cliff: 457, Cannabis no. 1, B [BM, lecto. (Stearn 1974)].

Herb, simple or branched, with robust taproot; stems angular, often with hollow internodes, up to ± 2 m. *Leaves* 3–7(–11)-foliolate; leaflets to 120 × 12 mm, sessile, apex acute or ± mucronate, base cuneate, margin serrate-biserrate; penninerved, midrib prominent beneath, membraneous-chartaceous, shortly coarse-hairy and yellow-glandular on both surfaces; petiole 20–60 mm; stipule up to 14 mm. *Inflorescences*: rarely both sexes on 1 plant and then 1 predominating. *Male inflorescences* numerous, few- to over 20-flowered, up to 200(–300) mm long; bracts short, up to 15 mm; pedicels up to 7 mm; perianth lobes 3–4 × 1 mm, adpressed-pubescent outside; anthers 3–4 mm; filaments 0.3–1.0 mm. *Female inflorescence* few-flowered, bracts often shorter than in male, enveloping bracteole 2–8 mm long, green. *Ovary* ± 1 mm diam.; stigmatic branches (1–)2–5 mm long. *Fruit* 3–4 × 2.0–3.5 mm, surface uniformly coloured, pale with prominent reticulate pattern of venation or, where persis-

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FIGURE 1.—*Cannabis sativa*. A–G, var. *sativa*: A, part of male plant, × 0.8; B, part of female plant with flowers and fruit, × 0.8; C, male flower, 1 tepal and 2 stamens removed, × 9; D, female flower, × 9; E, achene with enveloping bracteole, × 4.6; F, detail of bracteole surface × 17.5; G, achene (perianth absent), × 4.6. H, var. *indica*: part of female plant with flowers and fruit, × 0.8. A, C, E–G, *Leendertz 735*; B, D, *Viljoen 1629*. Artist: Eleanor Catherine.

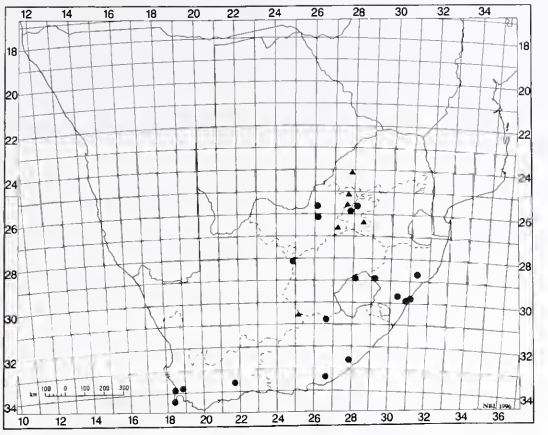

FIGURE 2.—Distribution of *Cannabis sativa*: naturalised, ●; cultivated, ▲.

tent perianth present, shiny, brownish or greyish, mottled with light and dark marbled pattern, venation visible beneath. Figure 1.

Found in Northern Province, North-West, Gauteng, KwaZulu-Natal, Lesotho, Free State and Western and Eastern Cape (especially southern parts) (Figure 2); naturalised as a weed of old cultivations; also widely cultivated for intoxicant resin and for fibre and seed-oil.

Known by the vernacular names of 'dagga' and 'hashish'.

A native of central Asia, widely cultivated and naturalised throughout the world.

Note: in the following key to varieties, measurements of plant height are intended merely as an approximate guide, since this character can vary greatly within each variety depending on environmental conditions, and useful comparison can be made only between plants in any one habitat.

1a Fruit small, usually less than 3.8 mm, base constricted; perianth persistent, giving mottled marble appearance with reticulation visible beneath; female plant small, up to ± 0.6 m, unbranched; leaves small; leaflets 3–5(–7), usually elliptic . . . . . 3. *C. sativa* var. *spontanea*

1b Fruit large, usually over 3.8 mm, base blunt, rounded; perianth deciduous or absent; fruit surface uniformly (usually pale) coloured with prominent reticulation; female plant tall or much-branched; leaves large; leaflets 5–11, oblanceolate or lanceolate:

2a Female plant tall (up to ± 2 m), laxly and sparsely branched; internodes long, hollow; leaflets 5–7, lanceolate . . . . . 1. *C. sativa* var. *sativa*

2b Female plant shorter (± 1 m) with many crowded branches giving compact congested appearance; internodes short, solid; leaflets usually 7–11, oblanceolate . . . . . 2. *C. sativa* var. *indica*

1. var. **sativa**

Plant (especially female) tall, laxly and rather sparsely branched; internodes long, ± hollow. *Leaves* large; leaflets 5–7, lanceolate, length 8–11 times width. *Perianth* poorly developed or readily deciduous from mature fruit surface; fruit surface when visible uniformly coloured, reticulate-patterned. *Fruit* at maturity usually longer than 3.8 mm with blunt base, ± persistent on plant. Figure 1A–G.

Plants modified by cultivation for 'hemp' fibre and seed oil.

Vouchers: *Codd 8506* (K); *Leendertz (3192) 9451* (PRE); *Moss 5199* (J); *Viljoen 1629* (PRE). Intermediate with var. *indica*: *Phillips 22378* (J); *Wood 3840* (BOL).

2. var. **indica** *(Lam.) Wehmer,* Die Pflanzenstoffe: 157 (1911) but see note in Small & Cronquist (1976). Type: India, *Sonnerat* (P, syn.).

C. indica Lam.: 687 (1785).

Plant (especially female) fairly short, robust with many short crowded branches giving congested appearance; internodes short, solid. *Leaves* large; leaflets (5–)7–11(–13), oblanceolate, length 5 or 6 times width. *Perianth* and *fruit* as in var. *sativa*. Figure 1H.

Plants modified by cultivation for intoxicant resin.

Vouchers: *Naude s.n.,* 23 April 1968; *Oates s.n.* comm. April-1878 (K); confiscated by Police, comm. 16 Jan. 1934; *Molyneux s.n.*, 1880 (BM).

3. var. **spontanea** *Vavilov* in Trudy Po Prikladnoi Botanike 1 Seletsii 13 (suppl. 23): 148 (1922). Type: USSR, grown at Kamenna experimental station in 1925 from seed collected near Saratov, 1921, *Andropova 121* (WIR, lecto.).

C. ruderalis Janischevsky: 14 (1924). Type: USSR, near Saratov, *Janischevsky s.n.* (LE, lecto.).

Plant (especially female), little branched if at all; internodes short, solid. *Leaves* small; leaflets 3–5(–7), usually elliptic, length 5 or 6 times width. *Perianth* fully developed and persistent around fruit, giving distinctive marbled appearance. *Fruit* at maturity usually less than 3.8 mm, with narrowed, slightly elongated base, readily disarticulating from plant.

Plants either little-modified by selective cultivation or de-domesticated by subsequent naturalisation and cross-breeding of cultivated forms. No material conforming to this taxon has been seen, but only intermediates resembling vars. *sativa* and *indica* in habit and with large seeds but with persistent perianth.

Vouchers: intermediate with var. *sativa*: *F.G.C. 2151* (J). Intermediate with var. *sativa* and var. *indica*: *Wood 3849* (K).

A further form has been recognised by Small & Cronquist (1976) as *C. sativa* subsp. *indica* var. *kafiristanica* (Vavilov) Small & Cronquist [possibly also corresponding to the form 'C. *sativa* L., small seeded' of Anderson (1980)], intermediate between vars. *sativa* and *spontanea* in habit and with seed characters of var. *spontanea* but with the high intoxicant resin content of var. *indica*. Whether or not such a form can be separated mor-

phologically, no specimens seen from southern Africa seem referable to this taxon.

REFERENCES

ADAMSON, R.S. 1950. In R.S. Adamson & T.M. Salter, *Flora of the Cape Peninsula*: 315, 316. Juta, Cape Town.

ANDERSON, L.C. 1980. Leaf variation among *Cannabis* species from a controlled garden. *Botanical Museum Leaflets, Harvard University* 28: 61–69. Cambridge, Massachusetts.

ANDREWS, F.W. 1952. *The flowering plants of the Anglo-Egyptian Sudan,* edn 2. Buncle, Arbroath.

BURTT DAVY, J. 1932. Cannabinaceae. *A manual of the flowering plants and ferns of the Transvaal and Swaziland, South Africa* 2: 445. Longmans, Green, London.

CUFODONTIS, G. 1953. Enumeratio plantarum aethiopiae 1. *Bulletin du Jardin Botanique de l'État, Bruxelles.* Suppl. Vol. 23.

DYER, R.A. 1975. *The genera of southern African flowering plants* 1. Department of Agricultural Technical Services, Pretoria.

EMBODEN, W.A. 1974. *Cannabis*, a polytypic genus. *Economic Botany* 28: 304–310.

EMBODEN, W.A. 1977. A taxonomy for *Cannabis*. *Taxon* 26: 110.

ENGLER, A. 1895. *Die Pflanzenwelt Ost-Afrikas und der Nachbargebiete,* Theil C. Dietrich Reimer, Berlin.

ENGLER, A. 1898. *Monographien afrikanischer Pflanzen-Familien und Gattungen, Fam.1 (Moraceae)* Vol. 1. Engelmann, Leipzig.

HAUMAN, L. 1948 Cannabaceae. *Flore du Congo Belge et du Ruanda-Urundi* 1: 176.

HENDERSON, M.D.& ANDERSON, J.G. 1966. Common weeds in South Africa. *Memoirs of the Botanical Survey of South Africa* No. 37: 70. Government Printer, Pretoria.

HIERN, W.P. 1900. *Catalogue of the African plants collected by Dr Friedrich Welwitsch in 1853–1861.* Vol. 1: 994, 995. London.

JACOT GUILLARMOD, A.F.M.G. 1971. *Flora of Lesotho.* Cramer, Lehre.

JANISCHEVSKY, D.E. 1924. Forma konopli na sorhykh mestakh v. Yugovostochnoi Rossii. *Uchenye zapiski saratovskogo gosudarstvennogo universiteta imeni N.G. Chernyshevskogo Saratov* 2, 2: 3–17.

KEAY, R.W.J. 1958. Cannabinaceae. *Flora of West tropical Africa,* edn 2, 1,2: 623.

KUBITZKI, K. 1993. Cannabaceae. In K. Kubitzki, T. G. Rohwr & V. Bittrich, *The families and genera of vascular plants—dicotyledons* 2. Springer-Verlag, Berlin.

LAMARCK, J.B.A.P.M. DE. 1785. *Dictionnaire encyclopédique méthodique* 1.

LINNAEUS, C. 1753. *Species plantarum,* edn 1. Salvius, Stockholm.

LINNAEUS, C. 1754. *Genera plantarum,* edn 5. Salvius, Stockholm.

MILLER, N.G. 1970. The genera of the Cannabaceae in the southeastern United States. *Journal of the Arnold Arboretum* 51: 185–203.

PHILLIPS, E.P. 1951. The genera of South African flowering plants, edn. 2. *Memoirs of the Botanical Survey of South Africa* No. 25. Government Printer, Pretoria.

PURSEGLOVE, J.W. 1968. *Tropical crops, dicotyledons* 1. Harlow, Longmans, London.

RENDLE, A.B. 1916. Cannabaceae. *Flora of tropical Africa* 6, 2: 16, 17.

ROSS, J.H. 1972. Flora of Natal. *Memoirs of the Botanical Survey of South Africa* No. 39.

SCHREIBER, A. 1958. Cannabaceae. In G. Hegi, *Illustrierte Flora von Mittel-Europa,* edn 2, Vol. 3: 290–295. Parey, Berlin, Hamburg.

SMALL, E. & CRONQUIST, A. 1976. A practical and natural taxonomy for *Cannabis*. *Taxon 25*: 405–435.

STEARN, W.T. 1970. The *Cannabis* plant: botanical characteristics. In C.R.B. Joyce & S.H. Curry, *The botany and chemistry of* Cannabis: 1–10. Churchill, London.

STEARN, W.T. 1974. Typification of *Cannabis sativa* L. *Botanical Museum Leaflets, Harvard University* 23: 325–336.

TREASE, G.E. 1952. *Text book of pharmacognosy,* edn 6. Baillierè.

VAVILOV, N.I. 1922. *Trudy Po Prikladnoi Botanike* 1, Seletsii 13 (suppl. 23): 148.

VERDCOURT, B. 1975. Cannabaceae. *Flora of tropical East Africa.*

VERDCOURT, B. & TRUMP, E.C. 1969. *Common poisonous plants of East Africa.* Collins, London.

WEHMER, C.E.W. 1911. *Die Pflanzenstoffe*: 157. Fischer, Jena.

WILLIAMS. R.O. 1949. *Useful and ornamental plants in Zanzibar and Pemba*. Zanzibar.

WILMOT-DEAR, C.M. 1991. Cannabaceae. *Flora zambesiaca* 9,6: 10–13.

Bothalia 29,2: 253–266 (1999)

Notes on African plants

VARIOUS AUTHORS

CONVOLVULACEAE

NOTES ON *DICHONDRA* AND *XENOSTEGIA* IN SOUTHERN AFRICA

Dichondra micrantha

In the revision of the South African Convolvulaceae by Meeuse (1957), the name *Dichondra repens* J.R. & G.Forst. (1776) is accepted for the only species of the genus *Dichondra* occurring in the region. This name is also accepted by Verdcourt (1963) for tropical East Africa, by Gonçalves (1987) for the *Flora zambesiaca* region, by Lejoly & Lisowski (1993) for Central Africa and by Welman (1993) for southern Africa, as well as by various other authors in publications dealing with the Convolvulaceae or the weeds in Africa south of the Sahara.

In South Africa this small procumbent, creeping herb is often cultivated as a ground cover or soil binder and sold under various names e.g. dewdrop lawn, wonder lawn. It grows as a weed in moist places in grassland and in cultivated and other disturbed areas and is recorded from isolated localities in mainly the eastern and northern parts of South Africa; so far there are no records in PRE from Swaziland.

Tharp & Johnston (1961) indicated that *D. repens* is endemic to Australia, Tasmania and New Zealand and that records from other areas under this name belong to various other species, chiefly *D. micrantha* Urban. Lawalree (1970) showed that the species that is widespread throughout the warmer regions of both hemispheres, is actually *D. micrantha* Urban which is accidentally or voluntarily spread by man as a weed or horticultural subject. He listed two important differences between the two species. In *D. micrantha* the peduncle is 3–20 mm long and recurved at maturity; the sepals are rounded or obtuse, shorter than 2.5 mm and shorter than the fruit. In *D. repens* the peduncle is 10–40 mm long and remains erect; the sepals are acute-acuminate, up to 5 mm long and longer than the fruit.

Bailey & Bailey (1977) accepted the name *D. micrantha* for the commonly cultivated *Dichondra*, although the name *D. repens* is still used in the horticultural trade. Forde (1978) proved that the species cultivated in lawns in New Zealand is *D. micrantha*. She pointed out that it differs from the native *D. repens* by the virtually glabrous upper leaf surfaces, the appressed silky pubescence below, the short-stalked flowers with violet anthers, the narrow pointed corolla lobes and the fruits greatly exceeding the calyx at maturity. The abundant and usually self-pollinated flowers are mostly hidden below the leaves on very short peduncles, which later recurve almost to bury the swollen indehiscent fruits.

Austin (1998) reported that Sebsebe Demissew and Austin investigated specimens of *Dichondra* from Africa and compared them with lawn seed sold by American companies. It was found that the commercial plants as well as all African specimens are *D. micrantha*. He pointed out that only two species of *Dichondra* are native to the Old World and they both occur in New Zealand and Australia. All other species of *Dichondra* are indigenous to the New World. *D. micrantha* is probably originally from North America, though the type was collected in Cuba where apparently it was already naturalised. It has been cultivated and distributed by man for the past 200 years and as a result is now widespread in both hemispheres, particularly in the warmer regions. It is used as a herbal medicine in China, presumably because of its resemblance to the medicinal *Centella asiatica* (L.) Urban (Apiaceae).

Dichondra in southern Africa should be listed as follows:

Dichondra micrantha *Urban* in Symbolae Antillanae 9: 243 (1924). Type: Cuba, Oriente province, Taco Bay, *E.L.Ekman 3851a* (S, holo.; B?, iso.).

D. repens auctt., non J.R. & G.Forst.: 40, t. 20 (1776).

Xenostegia tridentata subsp. *angustifolia*

In an article by Meeuse & Welman in *Bothalia* (1996), Meeuse published the combination *Xenostegia tridentata* (L.) Austin & Staples subsp. *angustifolia* (Jacq.) A.Meeuse. This was superfluous as this combination had previously been published by Lejoly & Lisowski in 1993.

The correct author citation is as follows:

Xenostegia tridentata (L.) *Austin & Staples* subsp. **angustifolia** (*Jacq.*) *Lejoly & Lisowski* in Fragmenta Floristica et Geobotanica 38: 379 (1993).

Ipomoea angustifolia Jacq.: 367 (1789). Iconotype: Jacq., Icones plantarum rariorum 2: 10, t. 317 (1786–1793), based on a specimen from Guinee.

Lejoly & Lisowski (1993) also published the new combination of another subspecies of *X. tridentata* namely subsp. *alatipes* (Dammer) Lejoly & Lisowski. This subspecies from tropical Africa has so far not been recorded for southern Africa.

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REFERENCES

AUSTIN, D.F. 1998. The indiscriminate vector: human distribution of *Dichondra micrantha* (Convolvulaceae). *Economic Botany* 52: 88–106.

BAILEY, L.H. & BAILEY, E.Z. 1977. *Hortus Third, a concise dictionary of plants cultivated in the United States and Canada*. Macmillan, New York.

FORDE, M.B. 1978. The cultivated dichondra. *New Zealand Journal of Botany* 16: 283–285.

FORSTER, J.R. & FORSTER, G. 1776. *Characteres generum plantarum*. White, Cadell & Elmsly, London.

GONÇALVES, M.L. 1987. Convolvulaceae. In E. Launert, *Flora zambesiaca*, Vol. 8,1. Flora Zambesiaca Managing Committee, London.

LAWALREE, A. 1970. Definition, aire et mode de dissemination de *Dichondra micrantha* Urban (Convolvulaceae). *Acta Botanica Neerlandica* 19: 717–721.

LEJOLY, J. & LISOWSKI, S. 1993. Les Convolvulaceae dans la flore d'Afrique Centrale (Zaïre, Rwanda, Burundi). *Fragmenta Floristica et Geobotanica* 38: 351–400.

MEEUSE, A.D.J. 1957. The South African Convolvulaceae. *Bothalia* 6: 641–792.

MEEUSE, A.D.J. & WELMAN, W.G. 1996. Convolvulaceae: new records, name changes and a new combination in southern Africa. *Bothalia* 26: 46–50.

THARP, B.C. & JOHNSTON, M.C. 1961. Recharacterisation of *Dichondra* (Convolvulaceae) and a revision of the North American species. *Brittonia* 13: 346–360.

URBAN, I. 1924. Plantae cubenses Ekman II. *Symbolae Antillanae* 9: 243.

VERDCOURT, B. 1963. Convolvulaceae. In C.E. Hubbard & E. Milne-Redhead, *Flora of tropical East Africa*. Crown Agents, London.

VON JACQUIN, N.J. 1786–1793. *Icones plantarum rariorum* 2. Vienna.

VON JACQUIN, N.J. 1789. *Collectanea austriaca ad botanicum* 2. Vienna.

WELMAN, W.G. 1993. Convolvulaceae. In T.H.Arnold & B.C. de Wet, Plants of southern Africa: names and distribution. *Memoirs of the Botanical Survey of South Africa* No. 62.

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CRASSULACEAE

CRASSULA MAPUTENSIS: A NEW RECORD FOR THE *FSA* REGION

At the time of its first description (R. Fernandes 1978), and subsequent treatment in the *Flora zambesiaca* (R. Fernandes 1983), *Crassula maputensis* was only known from southern Mozambique and Inhaca Island. The type specimen was recorded from Maputo Province, on the road between Salamanga and Ponta do Ouro. Its possible occurrence in KwaZulu-Natal was nevertheless suspected (R. Fernandes 1983).

Recent botanical collecting in KwaZulu-Natal and a study of herbarium collections in PRE, PRU, NH and LMU, have confirmed that *C. maputensis* is indeed present in northeastern KwaZulu-Natal (Maputaland). The latter area is part of the Maputaland Centre of Plant Endemism, with *C. maputensis* being one of more than 230 plant species or infraspecific taxa which are more or less restricted to this region (Van Wyk 1996). The known geographical distribution of *C. maputensis* is shown in Figure 1.

In southern African herbaria specimens of *C. maputensis* were sometimes filed under *C. expansa* Dryand., probably the nearest relative of our species. In fact, Tölken (1985) does not recognise *C. maputensis* as a separate species, but considers it merely as an extreme form of *C. expansa* subsp. *expansa* characterised by somewhat larger leaves and larger flowers. However, based on evidence from geographical distribution, ecology and macromorphology, the recognition of *C. maputensis* as a distinct species seems to be justified. In accordance with many other Maputaland Centre endemics, *C. maputensis* appears to be of fairly recent diversification (neoendemic), an impression supported by the fact that it is confined to the Maputaland coastal plain which is relatively youthful (Quarternary); and that its nearest relative, *C. expansa*, is still extant.

Crassula maputensis differs from *C. expansa* (Figures 2 & 3) by the broader (1.5–0.7 mm), flat, obtuse leaves, by the solitary axillary flowers which are usually borne all along the stems, and by the flowers with petals 1.5–2.0 mm wide. In *C. expansa* the leaves tend to be narrower, usually 1–2 mm, and more terete, particularly in subsp. *expansa*; the flowers are borne mainly on the distal parts of the stems, and are smaller with the petals 1.0–1.25 mm wide. Additional distinguishing characters are supplied by Fernandes (1983).

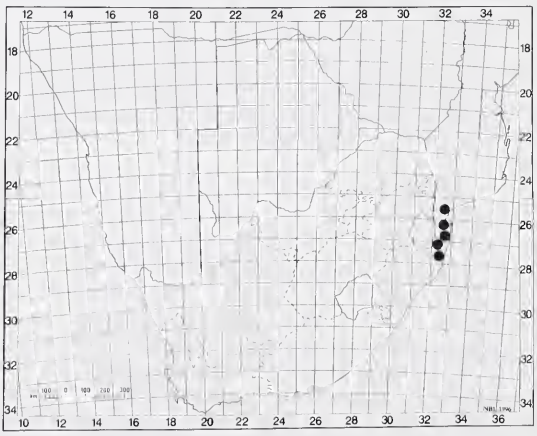

FIGURE 1.—Known distribution of *Crassula maputensis* based on collections at PRE, NH and LMU.

FIGURE 2.—*Crassula maputensis*. Habit, × 0.2. Note the long thin pedicels and single flowers. Photograph by A. Romanowski.

In KwaZulu-Natal *C. maputensis* is mainly associated with sand forest. The species has a prostrate habit with succulent, rather fragile stems and relatively thin, succulent leaves. The distribution of the species is erratic, with plants occurring as dense localised stands in well-shaded and somewhat moist places along the edges of forest and bush clumps. Soils at these sites are sandy and rich in humus. Sand forest is a rare vegetation type mainly associated with ancient north-south trending dunes on the Maputaland coastal plain. In view of its localised occurrence, and the rarity of its sand forest habitat, *C. maputensis* should be considered a vulnerable species.

Specimens examined

KWAZULU-NATAL.—2632 (Bela Vista): Ndumu Hill, (–CD), *Pooley 475* (NH). 2732 (Ubombo): Tembe Elephant Park, (–AB), *Van Wyk 12603* (PRU); Ingwavuma, (–BB), *Strey 4777*, *Tinley 511* (NH); Mtante, (–CA), *Ward 93*, (NH); False Bay Park, (–CD), *Lawson 369*, *459* (NH); Mpangazi, (–CD), *Strey 5085*, (PRE, NH).

MOZAMBIQUE.—2532 (Maputo): Magude, (–BA), *Correia & Marques 787* (LMU); Manhoca, (–DC), *Correia & Marques 2169* (LMU); Vila Luisa, (–DC), *Marques 2292* (LMU). 2632 (Bela Vista): Inhaca, (–BB), *Rodrigues, Pereira, Marques & Balsinhas 358* (LMU).

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FIGURE 3.—*Crassula expansa* subsp. *expansa*. Habit, × 0.2. Flowers are borne in clusters on short pedicels. Photograph by A. Romanowski.

REFERENCES

FERNANDES, R.B. 1978. Crassulaceae africanae novae vel minus cognitae. *Boletim da Sociedade Broteriana* 2, 52: 165–220.

FERNANDES, R. 1983. Crassulaceae. In E. Launert, *Flora zambesiaca* 7,1: 3–74.

TÖLKEN, H.R. 1985. Crassulaceae. *Flora of southern Africa* 14: 1–244.

VAN WYK, A.E. 1996. Biodiversity of the Maputaland Centre. In L.J.G. van der Maesen, X.M. van den Burgt & J.M. van Medenbach de Rooy, *The biodiversity of African plants*: 198–207. Kluwer Academic Publishers, Dordrecht.

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BRUNIACEAE

A NEW SPECIES OF *LINCONIA* FROM WESTERN CAPE

Linconia ericoides *E.G.H.Oliv.*, sp. nov., facie Ericae persimile, floribus *L. alopecuroideae* similissimis sed bracteolis 8–10 non 4, ovulis 8–10 non 2 per loculo, sed habitu perparva et foliis brevissimis (5.0–6.5 mm non 15–20 mm) differt; habitu *L. cuspidatae* similissima sed bracteolis 8–10 non 4(6), ovulis 8–10 non 2(4) per loculo, floribus urceolatis 11 mm longis non obconicis 4 mm longis differt.

TYPE.—Western Cape, 3420 (Caledon): Riviersonderend Mtns, eastern end, [5 km] WNW of Stormsvlei, SE main ridge NNW above Farm Hammerdene, 1650 ft [503 m], (–AA), 27 October 1998, *Oliver 11200* (NBG, holo.).

Small sparse woody shrublet up to 100 mm tall, with very gnarled woody spreading stem or rootstock. *Branches*: main branches 1–10, erect to spreading, sometimes pendulous, 30–100 mm long, leafy in upper part only, lateral branches occasionally 1 or 2, up to 10 mm long near apex of main branches, internodes short ± 0.4 mm long with infrafoliar ridges, puberulous with short hairs in young stages. *Leaves* erect to subspreading, incurved, 5.0–6.5 × 1.3–1.6 mm, obovate to oblong-obovate to oblong-elliptic, gradually reducing to a petiole-like base, ± flat adaxially and rounded abaxially with rounded margins, keeled in dry state, irregularly ciliate when very young in upper half with worm-like crisped hairs, otherwise glabrous, apical mucro small, red turning black; stipules ± 0.3 mm long, simple to bifurcate, black. *Inflorescence* of 1–3(5) flowers in axils of leaves just below tips of main branches and/or subterminal lateral branchlets aggregated into a loose head; pedicel very short, ± 0.5 mm long, covered by bracteoles; bracteoles 8–10 appressed imbricate, the lowest 1.4 × 1.2 mm, broadly ovate, the upper 3.5 × 2.0 mm broadly elliptic, occasionally with lateral lobes/teeth and a small dark mucro, hard but thin in texture, green with thin transparent marginal zone and red-flecked/striped, shortly ciliate with crisped hairs. *Calyx* 5-lobed, adnate to ovary, broadly conical with a few longitudinal ridges in basal half, glabrous; tube ± 0.2 mm long; lobes very broadly deltoid, subacute, appressed, very thin and transparent often flecked red. *Corolla* 5-lobed, fused slightly at base for 1.5–2.0 mm, 11 × 6 mm, urceolate to obovoid-urceolate; lobes erect naviculate subapically touching, basally with thickened Y-shaped ridges for ± $^1/_3$ their length, glabrous, hard and wax-like, pale to deep shell-pink with darker minutely cucullate tips. *Stamens* 5, included; filaments adnate to corolla tube at base, otherwise free, 7 × 1 mm, subcylindrical, very narrowed at point of attachment to anther, white to pinkish, glabrous; anthers 2.5 × 1.5 mm, sagittate with paler cap-like upper portion; thecae basally diverging, erect, dehiscing adaxially from large pore in lower $^1/_2$–$^2/_3$. *Ovary* 2-locular, $^1/_3$ inferior, 2.5 × 1.5 mm, complanate, deeply furrowed laterally between carpels, glabrous, green; ovules 8–10 per locule, subpendulous in two irregular longitudinal rows; placenta in upper $^2/_3$; styles 2, included, erect, touching apically then diverging for 1 mm, glabrous; stigma simple obtuse. Fruit not seen. Figure 4.

This new species belongs to a genus with only two species recorded thus far, *Linconia alopecuroidea* L. and *L. cuspidata* (Thunb.) Swartz (Pillans 1947). Florally the species is similar to the former, whereas vegetatively it is similar to the latter. A single collection made by Zeyher at Appelskraal near Riviersonderend occurs very near to the type locality of the new species and has not been recollected since the 1830's. Surprisingly the flowers of that collection are very small for *L. cuspidata*. Powrie (1969) investigated the typification of these species and commented on the identity of this collection, which Pillans (1947) had identified as *L. deusta* (Thunb.) Pillans, which name Powrie regards as a synonym of *L. cuspidata*, being just a small-flowered form, hence the two species recognised to date.

L. alopecuroidea has tall erect stems up to 600 mm with numerous long needle-like leaves up to 20 mm long, whereas *L. cuspidata* and *L. ericoides* form small woody shrublets up to 200 mm tall (occasionally up to 400 mm in the latter) growing in rocky places, often rock crevices, and have almost identical small leaves, 5–10 mm long. In the two previously described species the leaves are mostly long-ciliate at the base which is not the case in the new species. *L. alopecuroidea* and *L. ericoides* have large urceolate pink flowers (corolla 9–11 mm long), which in the former are shorter than and hidden by the leaves, and occur in racemes of up to 24 flowers. In *L. ericoides* the flowers are very conspicuous but occur only one to three in an inflorescence, sometimes up to five. In *L. cuspidata* the flowers are small (corolla 2.75–3.5 mm long), broadly obconical and dull white and as such are not very conspicuous on the plant, but are massed in 'heads' of up to 20 flowers.

Several floral differences serve to distinguish the new species from the other two. Both *L. alopecuroidea* and *L. cuspidata* have only two ovules per locule, which has been used as a distinguishing character for the genus, although we have noted up to four in *L. cuspidata*. *L. ericoides* has 8–10 ovules per locule. In the two previously described species there are only 4–6 bracteoles, whereas in the new species there are 8–10.

Material of this new species was sent to us as an unknown *Erica* species by Mr K. Langeveld and Mr L. van der Merwe of Bonnievale, who found the plants growing on the latter's farm. The *Erica* similarity was very obvious and all the more so when we visited the locality with them. Only 25 plants were located growing in fissures on rocky outcrops and small cliffs. The plants were very small and sparsely branched from a very old woody gnarled rootstock or stem that spread along the fissure. There were indications that the plants had sprouted from this rootstock. The branches were either erect to spreading out from the rock face or sometimes pendulous from near vertical faces.

On the slopes leading to the rocks and cliffs there were numerous plants of a shrubby pink-flowered species of *Erica*, *E. ovina*. Several plants of this species

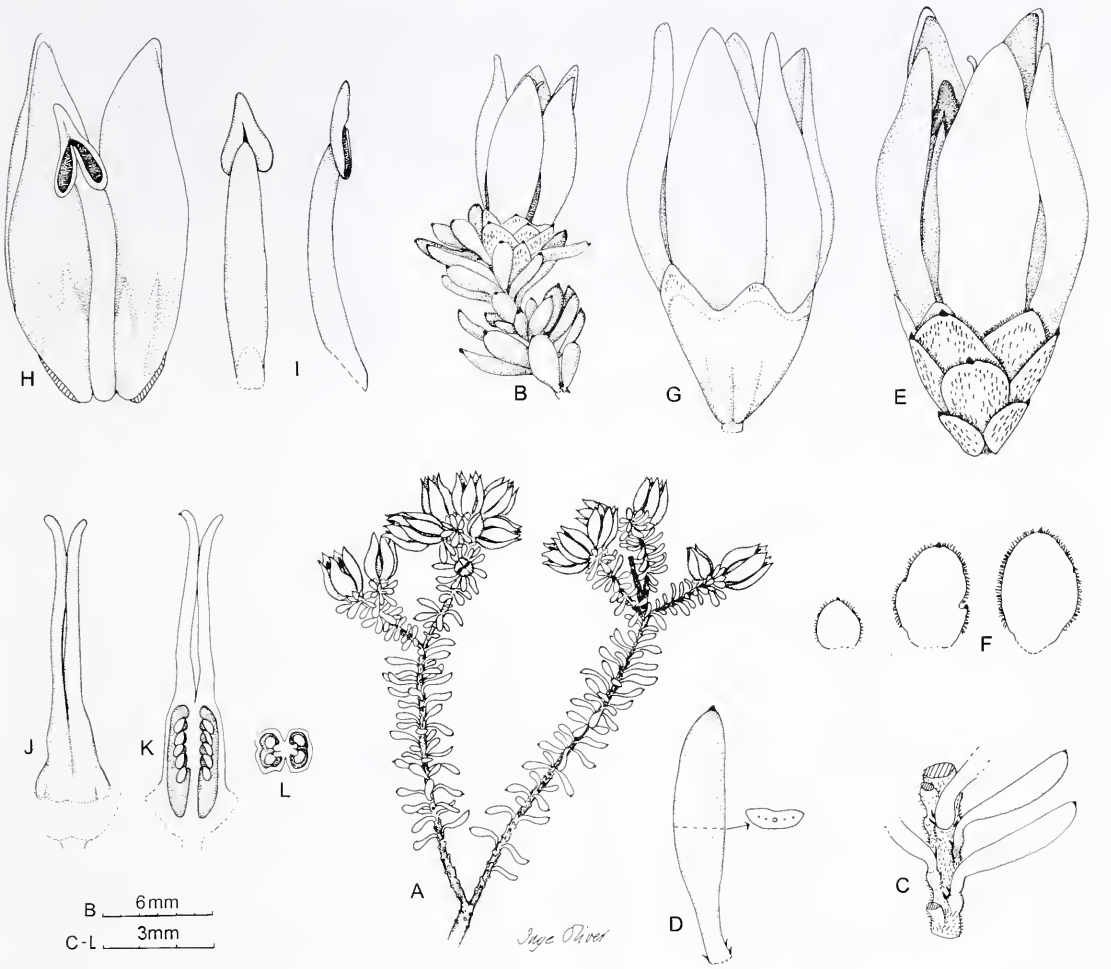

FIGURE 4.—*Linconia ericoides*. A, flowering branch, natural size; B, flowering branchlet; C, stem and leaves; D, leaf and cross section; E, flower; F, bracteoles; G, flower showing calyx; H, stamen, adaxial view, showing position in flower with basal ridges to petals; I, stamen, abaxial and lateral views; J, gynoecium; K, ovary opened laterally; L, ovary, cross section. Scale bars: B, 6 mm; C–L, 3 mm. All drawn from the type collection in the fresh state.

had managed to grow in the rock crevices and from a distance were almost identical to the *Linconia*, hence the specific epithet chosen, *ericoides*.

The habitat of *L. ericoides* raised the question of the biology of the species. With the similarity between the species and *Erica ovina* in the position, size, shape and colour of the flowers, one would postulate that the same pollinator was being used by both species, namely bees. No pollinators were noted visiting the plants at the time of our visit, but bees were seen on the more frequent plants of *E. ovina* lower down the mountain. The dispersal of seeds by wind from the lower populations must be the explanation for the chance germination of the *Erica* in the rock fissures, but not for the *Linconia*. No seeds are known for this species nor for *L. cuspidata*, but an old capsule from a previous season was found on herbarium material of *L. alopecuroidea*. The seeds showed a feature not known in the genus, namely an elaiosome. With the similarity in the flowers of *L. ericoides* and *L. alopecuroidea* it could be postulated that an elaiosome in the former would attract ants which may take the seeds into fissures in the rocks. This feature of rock-dwelling species has been noted by us in several species in the genus *Erica*.

The new species is known only from a single mountain slope in the eastern Riviersonderend Range (Figure 5) where it is quite separated from *L. alopecuroidea* which is known from a few scattered localities in the Langeberg (Figure 6). The other species, *L. cuspidata* is the most widespread and commonest species in the genus occurring in the southwestern part of the province from Ceres southwards to Hermanus (Figure 6) where it is recorded as growing in rocky places.

Powrie (1969) comments on the polymorphism in *L. cuspidata*. There is one collection which she may have overlooked since she cited only a few South African collections compared with the types. This is *Stokoe SAM66467* (SAM) from Oudebosch near the mouth of the Palmiet River. The flowers are very small with only one ovule per locule. The petals are unusual in being

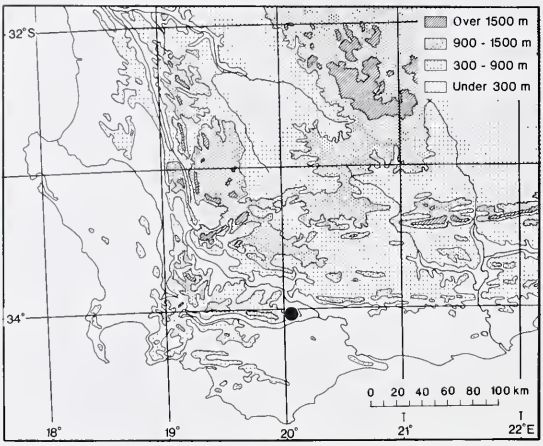

FIGURE 5.—Known distribution of *Linconia ericoides*.

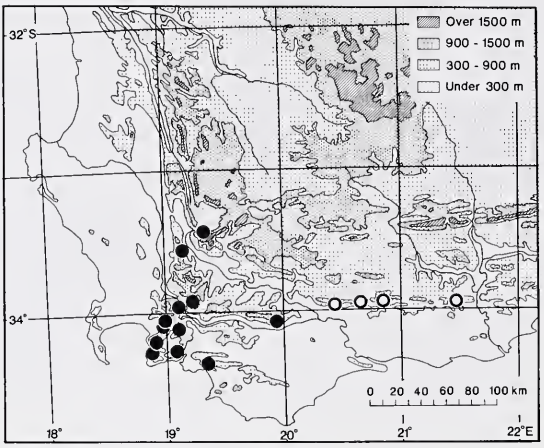

FIGURE 6.—Known distribution of *Linconia cuspidata*, ●, and *L. alopecuroidea*, ○.

slightly sagittate in the upper half as if they were becoming staminate.

PARATYPE.—Western Cape, 3420 (Swellendam): Stormsvlei, Riviersonderend Mtns, west of village, summit S-facing cliffs, cracks in rocks, (–AA), 15-11-1997, *Langeveld s.n.* (NBG).

REFERENCES

PILLANS, N.S. 1947. A revision of Bruniaceae. *Journal of South African Botany* 13: 121–206.

POWRIE, E. 1969. Types of Bruniaceae in the Thunberg herbarium. *Journal of South African Botany* 35: 327–339.

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AMARYLLIDACEAE: CYRTANTHEAE

NEW SPECIES AND NOTES ON *CYRTANTHUS* IN THE SOUTHERN CAPE, SOUTH AFRICA

INTRODUCTION

Cyrtanthus Aiton, a genus that extends from South Africa to East Africa, has some of the most highly ornamental representatives of Amaryllidaceae. About 55 *Cyrtanthus* species are currently recognised, some 53 of which are endemic to southern Africa (Nordal 1979; Reid & Dyer 1984; Hilliard & Burtt 1986; Snijman & Van Jaarsveld 1995). Until recently *Cyrtanthus* was regarded as a member of the tribe Haemantheae (Pax) Hutch. (Dahlgren *et al.* 1985) but following a cladistic analysis of molecular data in Amaryllidaceae (Meerow *et al.* in press), *Cyrtanthus* was re-allocated to its own tribe Cyrtantheae Salisb. (Meerow & Snijman 1998).

Cyrtanthus shows considerable variation in floral form and species differ greatly in the colour, size, shape, and position of their flowers. In addition, a few representatives have actinomorphic flowers and a straight perigone tube but mostly the flowers are zygomorphic. Zygomorphy in *Cyrtanthus* is expressed in the simplest state by the curvature of the perigone tube but this is further enhanced by the upward or downward curvature of the stamens and the style, and sometimes by the bilabiate arrangement of the tepals. In the Cape Region, *Cyrtanthus* species are known to attract a variety of animal visitors. Species with wide, funnel-shaped, red flowers are pollinated by the Mountain pride butterfly, *Aeropetes tulbaghia* (L.) (Johnson & Bond 1994); those with tubular red flowers are visited by both the Lesser double-collared sunbird *Nectarinia chalybea* (L.) (pers. obs.) and the Mountain pride butterfly (Le Maitre & Brown 1992); while species with tubular, cream-coloured, scented flowers are considered to be attractive to moths (J.C. Manning pers. comm.). Although phylogenetic studies are yet to reveal the sequence in which the flower evolved in *Cyrtanthus*, it is probable that the slender, curved perigone tube has been a key feature that allowed the flower to undergo selection in response to a wide variety of specialised pollinators during the lineage's history.

The recent discovery of two rare, new species from the southern Cape extends the known diversity of floral form in *Cyrtanthus* still further. In *C. leptosiphon*, a species discovered near Swellendam in 1981, the cream-coloured to pinkish flowers are long-tubed, and the tepals are weakly bilabiate. The second new discovery, *C. wellandii*, found near Hankey in 1996, has small, widely flared, vermilion to scarlet flowers. As yet, this is the only known *Cyrtanthus* species in which the style remains included in the lower half of the perigone tube, below the stamen insertion.

In her taxonomic treatment of *Cyrtanthus* in East Africa, Nordal (1979) chose subspecific rank for putative sister taxa that differ by small quantitative characters of the leaves and flowers. In contrast, Reid & Dyer (1984) recognised the smallest diagnosable units as species, even those defined by small—but apparently constant—quantitative morphological differences. In accordance with the methods of Reid & Dyer (1984), the phylogenetic species concept has been applied when describing the species below.

Cyrtanthus leptosiphon *Snijman*, sp. nov., quoad folia angusta et hysterantha, flores tubulares et cremeos, et segmentis superantibus 7.5 mm ad *C. ochroleucum* (Herb.) Burch. ex Steud. et *C. leucanthum* Schltr. accedit, sed ab eis differt pedicellis brevibus (3–5 mm), tepalis bilabiatis inferme, costa incrassata tepali, et stigmate trilobo minute. Figura 7.

TYPE.—Western Cape, 3420 (Bredasdorp): near Buffeljagsrivier, (–BA), along road to Suurbraak, 15-3-1997, *Goldblatt 10621* (NBG, holo.; K, PRE).

Deciduous bulbous herb, 200–300 mm tall when flowering. *Bulbs* clumped, hypogeal, ovate, up to 30–50 mm long, 30–35 mm diam., without a prominent neck; outer tunics brown and papery; inner tunics cream-coloured and fleshy. *Leaves* 1–5, absent or sometimes present at flowering, linear, 165–220 × 2.0–2.8 mm, suberect, twisted 1 or 2 times, glabrous, shallowly channelled adaxially, with 3 distinct median veins but not keeled abaxially. *Inflorescence* (1)2(3 or 4)-flowered; scape erect, up to 250 mm long, 3–5 mm diam., tapering distally, pink to green with a grey bloom, hollow throughout or sometimes solid towards base; spathe valves 2, equitant, narrowly lanceolate, up to 30 × 6 mm, membranous, soon becoming papery and reflexed; bracteoles up to 4, filiform, up to 15 mm long; pedicels erect, 3–5 mm long at anthesis, pinkish green, finally up to 9 mm, 2 mm diam., green. *Flowers* erect, 60–93 mm long, tubular, weakly bilabiate, pale salmon to cream-coloured, often with shell pink or peach on perigone tube and median keels of tepals, unscented; tube straight in proximal half, slightly curved distally, 45–65 mm long, 1.5–2.5 mm diam. at base, widening gradually to 6–8 mm at throat; tepals oblong to subacute, 15–25 × 6–10 mm wide, with a prominent 3–5-veined midrib; outer whorl as wide or wider than inner whorl, shortly mucronate; upper 3 tepals connivent for more than half their length, spreading distally; lower 3 tepals overlapping proximally, spreading widely for more than half their length. *Stamens* biseriate; filaments ± 5 mm long, slightly incurved distally, peach-coloured; outer whorl inserted in throat; inner whorl inserted near proximal third of inner tepals; anthers dorsifixed, oblong, 2 mm long, yellow. *Ovary* ellipsoidal, 5–6 × 2–3 mm, green; ovules axile, ± 12 per locule. *Style* arched against uppermost tepal, reaching as far as outer anthers, incurved distally, pale pink to cream-coloured; stigma minutely 3-lobed, papillate. *Capsule* unknown.

Phenology

Flowering in the population extends from late February to early April. The plants flower most prolifically in recently burnt veld but occasional flowers have been seen in open, partially disturbed, unburned vegetation. The individual flowers of *C. leptosiphon* are short-lived and each lasts up to four days. Mostly the bulbs bloom without their foliage leaves, which emerge at the beginning of summer and rapidly dry off with the onset of autumn.

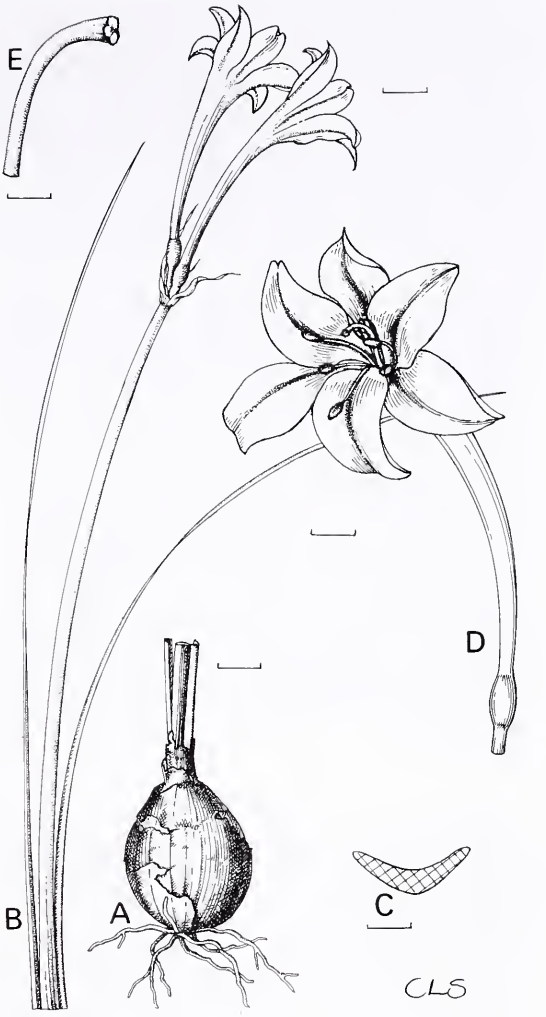

FIGURE 7.—*Cyrtanthus leptosiphon*. A, bulb; B, inflorescence and leaves; C, transverse section through leaf blade; D, flower; E, distal end of style and stigma. Drawn from *Goldblatt 10621* by Claire Linder Smith. Scale bars: A–B, 10 mm; C, 1 mm; D, 5 mm; E, 2.5 mm.

Diagnostic features

Cyrtanthus leptosiphon is similar to two other Cape species, *C. leucanthus* Schltr. and *C. ochroleucus* (Herb.) Burch. ex Steud. (sensu Dyer 1939 and Reid & Dyer 1984, non Batten & Bokelmann 1966 t. 24:1). All three species have narrow (less than 5 mm wide), hysteranthous leaves and long (50–93 mm), narrow-tubed, cream-coloured or yellowish flowers (sometimes flushed with pink), in

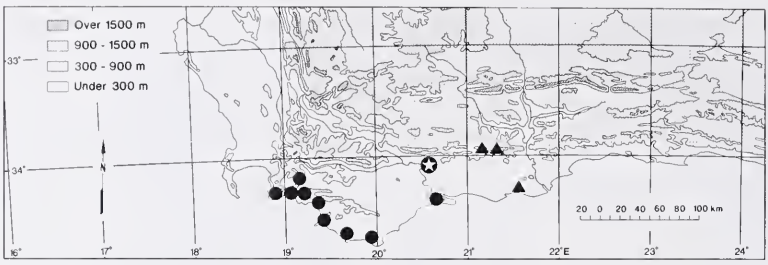

FIGURE 8.—Known distributions of *Cyrtanthus leptosiphon*, ✪; *C. leucanthus*, ●; and *C. ochroleucus*, ▲, based on collections at BOL, NBG, PRE and SAM.

which the tepals are longer than 7.5 mm and slightly spreading. Within this group *C. leptosiphon* is easily distinguished by its short pedicels (3–5 mm long) and weakly bilabiate flowers. Furthermore, the tepals are prominently ribbed with 3–5 veins and the style is minutely 3-lobed. In contrast, *C. leucanthus*, an endemic of the coastal fynbos between Rooiels and the Potberg (Figure 8), has sweet-smelling, cream-coloured flowers in which the tepals are broad (7–13 mm), many-nerved (7 or more), and regularly overlapping. *C. ochroleucus*, a more easterly species, found in neutral sands in the Langeberg and the coastal forelands near Albertinia (Figure 8), has dull-smelling, brownish or greenish yellow flowers with narrow (3–5 mm) tepals, each with 3–5 veins. Unlike the tepal veins of *C. leptosiphon* and *C. ochroleucus*, those of *C. leucanthus* curve outwards to the tepal margins. A synopsis of the floral differences between the three species is given in Table 1.

Other narrow-tubed *Cyrtanthus* species that have bilabiate flowers are *C. fergusoniae* L.Bolus, *C. inaequalis* N.E.Br., and *C. labiatus* R.A.Dyer but unlike *C. leptosiphon* these species are red-flowered and most likely bird-pollinated.

Elsewhere in the genus, floral zygomorphy is also shown to some extent in species with more or less flared flowers. Although the tepals are regularly arranged, the stamens and style arch against the upper tepal in the slightly flared flowers of *C. ventricosus* (Jacq.) Willd., whereas in the group of wide-tubed species comprising *C. clavatus* (L'Hér.) R.A.Dyer, *C. speciosus* R.A.Dyer, *C. loddigesianus* (Herb.) R.A.Dyer, *C. helictus* Lehm., *C. smithiae* Watt ex Harv., *C. thorncroftii* C.H.Wright, *C. galpinii* Baker, *C. sanguineus* (Lindl.) Walp., and *C. eucallus* R.A.Dyer, the stamens and style curve downwards from within the throat.

Distribution and biology

Records show that *C. leptosiphon* is known from a few isolated populations in marginal fynbos and renosterveld, close to the Buffeljagsrivier, in the foothills of the Langeberg, east of Swellendam (Figure 8). The populations favour pebble-strewn loamy soils along the interface of shale and sandstone of the Table Mountain Group. Other plants in the community are species of Poaceae, *Leucadendron, Cliffortia, Restio, Erica*, and *Rhus*.

In the Langeberg region, several other autumn-flowering species have pale, long-tubed flowers, similar to those of *C. leptosiphon*: notably *Gladiolus bilineatus*, *G. engysiphon*, and several *Pelargonium* species. Goldblatt & Manning (1998) have recorded a species of long-tongued fly, *Prosoeca longipennis* (Loew) (Nemestrinidae), which is active in autumn, foraging for nectar on these species. Although *C. leptosiphon* is probably another member of this guild, a careful search for the pollinator of *C. leptosiphon* and *G. bilineatus* at the Buffeljagsrivier site was unsuccessful. Correspondingly, it has not yet been possible to document the capsule and seeds of *C. leptosiphon*.

When Mr Jan Vlok first collected the species in 1981 he noted that the habitat faced possible demise through man-induced disturbances. In 1999 these conditions were still evident. Accordingly, *C. leptosiphon* is regarded as Vulnerable: C2a in terms of the IUCN Red List Categories and Criteria of 1994.

Unfortunately, like many other deciduous species, *C. leptosiphon* has proved difficult to maintain in cultivation (G.D. Duncan, Kirstenbosch Botanic Garden, pers.comm.).

WESTERN CAPE.—3420 (Bredasdorp): near Buffeljagsrivier, along the road to Suurbraak, (–BA), *Goldblatt 10489* (NBG); *Goldblatt 10621* (K, NBG, PRE); *Viviers 187* (NBG); Buffeljagsrivier, Farm Middenplaas, *Vlok 172, 173* (NBG).

TABLE 1.—Comparison of the floral characters that distinguish *Cyrtanthus leptosiphon* Snijman, *C. leucanthus* Schltr., and *C. ochroleucus* (Herb.) Burch. ex Steud.

Characters	*C. leptosiphon*	*C. leucanthus*	*C. ochroleucus*
Pedicel length at anthesis	3–5 mm	7–20 mm	5–15 mm
Floral fragrance	absent	sweet	dull
Tepal arrangement	± bilabiate	regular	regular
Tepal length	15–25 mm	13–24 mm	8–10 mm
Tepal width	6–10 mm	7–13 mm	3–5 mm
Tepal veins	3–5, median only	7 or more, median & lateral	3–5, mostly median
Stigma	minutely 3-lobed	3-branched	shortly 3-branched

Cyrtanthus wellandii *Snijman*, sp. nov., forma et coloris floris *C. collini* Ker Gawl. similis, praecipue differt floribus parvis (36–42 mm longis), tubo expanso distincte, et stylo brevi (usque ad 9 mm longum). Figura 9.

TYPE.—Eastern Cape, 3324 (Steytlerville): W bank of Kabeljouws River, Farm Misgund, (–DD), 20-2-1997, *Snijman 1575* (NBG, holo.; K, PRE).

Deciduous bulbous herb, 200–400 mm tall when flowering. *Bulb* solitary, hypogeal, narrowly ovate, 40–50 mm long, up to 30 mm diam., sometimes extended into a narrow neck up to 10 mm long; outer tunics brown and papery; inner tunics cream-coloured and fleshy. *Leaves* 2 or 3, appearing at or shortly after flowering, linear, up to 190 × 3 mm, suberect to recurved distally, red proximally otherwise light green, deeply channelled adaxially, keeled abaxially; keel mostly three-nerved becoming one-nerved distally, sometimes minutely papillate. *Inflorescence* 4–7-flowered; scape erect, up to 350 mm long, ± 3–5 mm diam., tapering distally, pale pink to pale green or brownish pink, covered with a grey bloom, hollow from base upwards; spathe valves 2, equitant, narrowly lanceolate, up to 35 × 7 mm, initially pale green, soon becoming brown and reflexed; bracteoles up to 7, narrow, up to 15 mm long; pedicels erect, varying in length, 6–24 mm long at anthesis, 2 mm diam., brownish green. *Flowers* spreading horizontally, 36–42 mm long, funnel-shaped, regular, vermilion to scarlet, ageing to dull red, with 6 faint white streaks leading downwards from tepal sinuses, unscented; tube 23–25 mm long, lower 3–5 mm narrow, up to 2 mm diam., more or less bent at right angles, upper 15–20 mm flaring open to 8–10 mm wide at throat; tepals oblong to oblong-lanceolate, 11–16 × 6–8 mm, outspread at anthesis forming a flat or sometimes slightly recurved rim, 5-veined, soft-textured, without a thickened median rib; outer whorl shortly mucronate, slightly wider than inner. *Stamens* biseriate, regular; filaments ± 1.5 mm long, incurved, white, inserted ± half way up tube, with the inner inserted ± 2.5 mm above outer; anthers dorsifixed, oblong, 1.75 mm long, yellow. *Ovary* ellipsoidal, 5–6 × 3–5 mm, green; ovules axile ± 9 per locule. *Style* straight, up to 9 mm long, remaining in tube, ± 4–5 mm below lowermost stamen insertion, white; stigma 3-lobed, papillate; lobes broad, less than 0.25 mm long. *Capsule* narrowly elliptical, 20 × 7 mm, 3-valved; valves reflexing when dry. *Seeds* black, flattened, wrinkled, 7 × 4 mm.

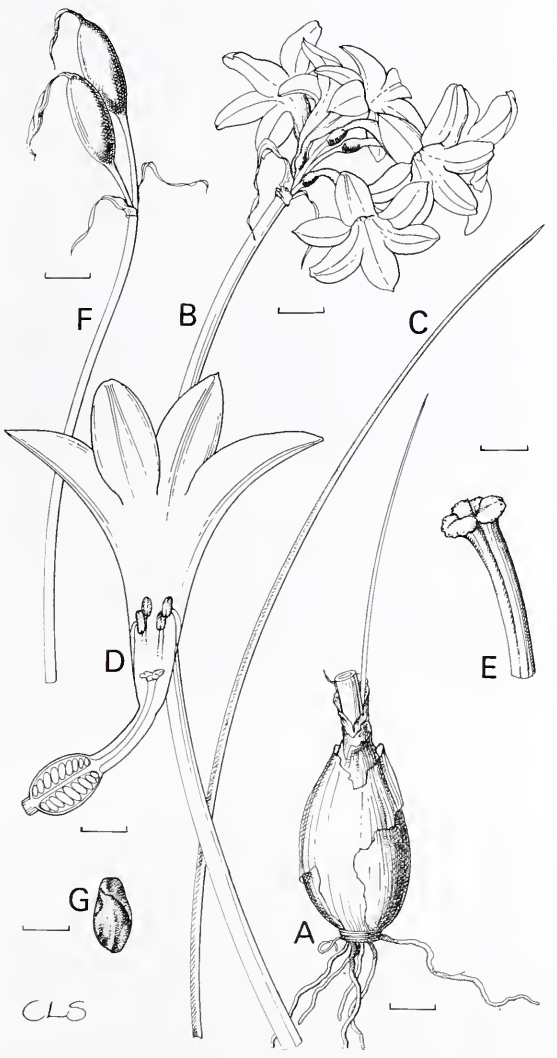

FIGURE 9.—*Cyrtanthus wellandii*: A, bulb and young leaf; B, inflorescence; C, mature leaf; D, flower; E, distal end of style and stigma; F, infructescence; G, seed. Drawn from *Snijman 1575* by Claire Linder Smith. Scale bars: A–C, F, 10 mm; D, G, 5 mm; E, 2 mm.

Phenology

Cyrtanthus wellandii flowers in mid February, often after the foliage leaves, which appear in summer and begin to dry off in autumn. Although its habitat is periodically burned, the flowering of *C. wellandii* is not fire-induced. In cultivation the bulbs flower freely and if kept indoors the individual flowers remain fresh for ± 10 days.

Diagnostic features

Cyrtanthus wellandii is unique in the genus in having a style that remains included in the lower half of the perigone tube, ± 4–5 mm short of the lowermost filament insertion. In floral form and colour, *C. wellandii* is most similar to *C. collinus* Ker Gawl., a species known from scattered collections, in rocky, fynbos communities from the mountains between Genadendal, near Caledon and the Gamka Mountain Nature Reserve, near Oudtshoorn (Figure 10). Both species have equally long tepals (11–16 mm and 9–15 mm respectively) that flare open, although the perigone tube of *C. wellandii* is consistently more flared and usually shorter (23–25 mm) than that of *C. collinus* (23–30 mm). Moreover, several other subtle floral characters separate the species. The tepals of *C. wellandii*, which remain outspread until the entire flower collapses, are 5-veined in both whorls, whereas in *C. collinus* the tepals flare initially but readily become connivent before the flower collapses; the outer tepals are 3–5-veined, while the inner tepals are only 3-veined. Finally, whereas *C. wellandii* has a stigma with three, broad lobes of less than 0.25 mm long, the stigma of *C. collinus* is distinctly tripartite, with narrow branches up to 1 mm long.

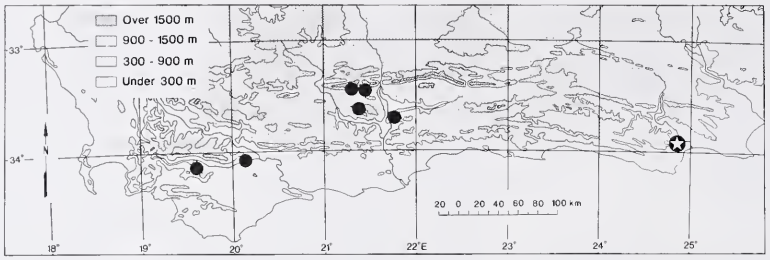

FIGURE 10.—Known distributions of *Cyrtanthus wellandii*, ✪; and *C. collinus*, ●, based on collections at BOL, NBG, PRE and SAM.

Many protandrous flowers are known to have short styles in the early stages of floral development. The style of *C. wellandii*, however, remains short through all its stages. As yet, little is known about the species' breeding biology. However, in the absence of hand-pollination, the few plants that have been grown under cover have not produced seeds. Although these observations are preliminary, they suggest that the short, included style of *C. wellandii* is not associated with selfing.

Distribution and habitat

Cyrtanthus wellandii is known only from a single population on the coastal forelands overlooking the Kabeljouws River Valley in the Hankey District (Figure 10). The population, which appears to face no immediate threat, is locally abundant in well-drained loamy soils, amongst occasional quartzite rocks. Due to its small area of occupancy the species has been assessed as belonging to the IUCN category: Vulnerable D2.

As the Kabeljouws River cuts across the coastal forelands, it passes through several geological formations, mainly the shales and sandstones of the Table Mountain Group and the Enon Conglomerates of the Uitenhage Group. Thus the Hankey region has diverse soils, each with their own nutrient and moisture status, which support a complex mixture of vegetation types. The area of the Kabeljouws River valley where *C. wellandii* is found receives less than 500 mm rain per annum, predominantly in early summer and autumn (J.J. du Plessis pers. comm.). The population occurs in association with *Elytropappus rhinocerotis* (L.f.) Less., and species of *Tetraria, Aspalathus, Bobartia, Argyrolobium*, and Poaceae, in a community which Cowling (1984) describes as Hankey Coast Renosterveld.

Etymology

Cyrtanthus wellandii commemorates Mr Welland Cowley of Port Elizabeth, who first discovered the species in 1996 and subsequently brought this highly ornamental plant into cultivation, mainly from seed.

EASTERN CAPE.—3324 (Steytlerville): W bank of Kabeljouws River, Farm Misgund, (–DD), *Cowley s.n.* (NBG); *Snijman 1575* (K, NBG, PRE).

Cyrtanthus collinus *Ker Gawl.*

Cyrtanthus collinus has been interpreted in a variety of ways since Ker Gawler (1816) first described the species. Baker (1896) included specimens from both the Western Cape (Baviaanskloof, Genadendal, *Burchell 7783*) and Eastern Cape (Zuurberg Range, *Cooper 3223*) within his circumscription, whereas Dyer (1939) included specimens only from the Western Cape in his treatment of *C. collinus*. In the most recent revision of the genus, Reid & Dyer (1984) cited the provenance of the holotype of *C. collinus* (*Burchell 7783*, K) as 'Uitenhage district', as did Baker (1888). Accordingly, Reid & Dyer (1984) used a photograph of an Eastern Cape plant, collected by G. Skinner (*PRE37826*) from the Grootrivier, between Armandsvriend and Hedley Road, to illustrate the species.

An examination of Burchell's hand-written label on the holotype of *C. collinus* has since confirmed that the collection comes from the Baviaanskloof Mountain near Genadendal, in the Caledon District. Moreover, several specimens that match the holotype of *C. collinus* have been collected from this area. In particular, *Rourke 330* (NBG) and *Snijman 1666* (NBG) are accompanied by photographs which show that the flowers of *C. collinus sensu stricto* have a trifid style that arches against the upper tepal. This is in contrast to the deflexed position of the style seen in the flowers of G. Skinner (*PRE37826*), which Reid & Dyer (1984: fig. 3) used to depict their concept of *C. collinus*.

In conclusion, although field studies on population variation and pollination mechanisms are needed to expand upon these preliminary observations, the floral characters that distinguish *C. collinus sensu stricto* suggest that the Eastern Cape plants, which have been called *C. collinus* in accordance with Reid & Dyer's treatment (1984), may well have other affinities and may yet be shown to belong to *C. staadensis* Schönland *sensu lato*.

Specimens examined

WESTERN CAPE.—3321 (Ladismith): southern slopes of Klein Swartberg, (–AD), *Vlok 139* (NBG); Seven Weeks Poort, *Wurts 1328* (NBG); Calitzdorp, Rooiberg on Bailey's Peak, (–BC), *Vlok 138* (NBG); Gamka Mountain Nature Reserve, (–DB), *Erasmus 145* (NBG). 3419 (Caledon): Baviaanskloof near Genadendal, (–BA), *Burchell 7783* (K); *Gillett 862* (BOL); Genadendal, Kanonkop, *Esterhuysen 35618* (BOL); *Rourke 330* (NBG); Greyton, below Uitkykkop, *Snijman 1665* (NBG); Greyton, Paardekop Peak, *Stokoe s.n.* (*BOL7422, SAM55864*); *Zinn s.n.* (*SAM55721*). 3420 (Bredasdorp): Riviersonderend, lower south east slopes of Dasberg, (–AA), *Taswell Yates sub Manning 1085* (NBG).

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REFERENCES

BAKER, J.G. 1888. *Handbook of the Amaryllideae*. George Bell, London.
BAKER, J.G. 1896. *Cyrtanthus. Flora capensis* 6: 218–228.
BATTEN, A. & BOKELMANN, H. 1966. *Wild flowers of the Eastern Cape Province*. Books of Africa, Cape Town.
COWLING, R.M. 1984. A syntaxonomic and synecological study in the Humansdorp region of the Fynbos Biome. *Bothalia* 15: 175–227.
DAHLGREN, R.M.T., CLIFFORD, H.T. & YEO, P.F. 1985. *The families of the Monocotyledons*. Springer-Verlag, Berlin.
DYER, R.A. 1939. A review of the genus *Cyrtanthus*. *Herbertia* 6: 65–103.
GOLDBLATT, P. & MANNING, J.C. 1998. Gladiolus *in southern Africa*. Fernwood Press, Vlaeberg.
HILLIARD, O.M. & BURTT, B.L. 1986. Notes on some plants of southern Africa chiefly from Natal: 12. *Notes from the Royal Botanic Garden Edinburgh* 43: 189–228.
JOHNSON, S. & BOND, W. 1994. Red flowers and butterfly pollination in the fynbos of South Africa. In M. Arianoutsou & R.H. Groves, *Plant-animal interactions in Mediterranean-type ecosystems*: 137–148. Kluwer, Dordrecht.
KER GAWLER, J.B. 1816. *Cyrtanthus collinus*: narrow glaucous-leaved *Cyrtanthus*. *Botanical Register* 11: t. 162.
LE MAITRE, D.C. & BROWN, P.J. 1992. Life cycles and fire-stimulated flowering in geophytes. In B.W. van Wilgen, D.M. Richardson, F.J. Kruger & H.J. van Hensbergen, *Fire in South African Mountain Fynbos*: 145–160. Springer-Verlag, Berlin.
MEEROW, A.W., FAY, M.F., GUY, C.L., LI, Q-B., ZAMAN, F.Q. & CHASE, M.W. in press. Systematics of Amaryllidaceae, based on cladistic analysis of plastid rbcL and trnL-F sequence data. *American Journal of Botany* 86.
MEEROW, A.W. & SNIJMAN, D.A. 1998. Amaryllidaceae. In K. Kubitzki, *The families and genera of vascular plants 3: flowering plants, monocotyledons*: 83–110. Springer, Berlin.
NORDAL, I. 1979. Revision of the genus *Cyrtanthus* (Amaryllidaceae) in East Africa. *Norwegian Journal of Botany* 26: 183–192.
REID, C. & DYER, R.A. 1984. *A review of the southern African species of* Cyrtanthus. American Plant Life Society, La Jolla.
SNIJMAN, D.A. & VAN JAARSVELD, E.J. 1995. *Cyrtanthus flammosus*. *Flowering Plants of Africa* 54: 100–103.

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PROTEACEAE

A NEW SPECIES OF *SERRURIA* FROM THE SOUTHERN CAPE, SOUTH AFRICA

Serruria Salisb. consisting of some 54 species, is the largest genus of the Proteaceae endemic to Western Cape. Dr Tony Rebelo, initiator of the Protea Atlas Project discovered this extraordinary species in July 1998. No earlier collections are known, which is scarcely surprising considering its cryptic growth habit and very localised distribution. When not flowering, mature plants are exceptionally difficult to detect in the field, even at known sites.

Serruria rebeloi *Rourke*, sp. nov. Fruticulus prostratus, ramis glabris gracilibus; foliis secundis praecipue aciculariibus (aliquando 2-, 3-, vel 4-furcatis), racemis minimis sessilibus terminalibus, 4–9 floribus, perianthiis brevissimis, 7–8 mm longis, et ovariis stylopodio, distinguitur.

Fruticulus diffusus, prostratus ad 200 mm altus, 1 m in diametro. *Rami* graciles vel filiformes, implexi, 1.5 mm in diametro, glabri aut pilis paucis dispersis. Folia secunda, 30–50 mm longa, bipinnata, 2-, 3-, vel 4-furcata sed aciforma apicem versus; primum sparse puberula, demum glabra. *Inflorescentia* racemosa parvula, 10–12 mm in diametro; obovoidea, sessilis, solitaria et terminalis, (4)5–7(–9) floribus. *Bracteae* 6–8, peranguste lanceolato-acuminatae, 8–10 × 0.5–1.0 mm, glabrae sed ciliis marginalibus. *Perianthium* 7–9 mm longum, rectum ante anthesin, dense villosum. *Stylus* rectus, glaber, 7–8 mm longus. *Ovarium* sphaericum, 2 mm longum, dense villosum, stylopodio cylindrico carmineo superpositum. *Squamae hypogynae* absentes (Figura 11).

TYPE.—Western Cape, 3419 (Caledon): Boskloof, south of Akkedisberg, on watershed of Kars and Uilkraal Rivers, (–BC), 1-10-1998, *J.P. Rourke 2151* (NBG holo.; BOL, E, K, MO, NSW, PRE, S, W).

FIGURE 11.—*Serruria rebeloi*, open inflorescences, ± life size.

FIGURE 12.—*Serruria rebeloi*. A, flowering shoot; B, detached inflorescence; C, floral bract; D, unopened flower bud; E, single flower at anthesis; F, ovary, style and pollen presenter; G, ovary with gynophore and style attached; H, mature fruit. Scale bars: 1 mm. Drawn from *J.P. Rourke 2151*. Artist: Claire Linder Smith.

Low, prostrate, diffuse shrublet up to 200 mm high and 1 m diam. with horizontally trailing branches; forming a loose tangled mat from a single main stem up to 50 mm tall, 15 mm diam. *Branches* very slender to almost filiform, 1.5 mm diam., reddish, glabrous or nearly glabrous with a few scattered hairs; branches very rarely divided. *Leaves* secund, 30–50 mm long, very sparsely puberulous when young but soon glabrous, bipinnate becoming 2-, 3-, or 4-furcate, but frequently simple and acicular towards shoot apex; filiform, terete, upper surface canaliculate, apices reddish, mucronate. *Inflorescence* an obovoid, sessile, usually solitary, much reduced terminal raceme, 10–12 mm diam., (4)5–7(–9)-flowered; very rarely with up to 4 axillary inflorescences below terminal raceme. *Involucral bracts* 6–8, loosely arranged, very narrowly lanceolate-acuminate, 8–10 × 0.5–1.0 mm, deep carmine, glabrous but with a few scattered marginal cilia. *Floral bracts* narrowly ovate-acuminate, 8–10 × 3 mm, apices patent, bases clasping, minutely pubescent, margins ciliate. *Perianth* 7–9 mm long, straight in bud; limbs and claws uniformly thickly villous; limbs ovate-acute, 1 mm long; tube region glabrous; perianth segments opening equally at right angles. *Anthers* sessile. *Style* straight, glabrous, 7–8 mm long; pollen presenter clavate, 1 mm long, stigmatic groove terminal; style base connected to ovary by a cylindrical, fleshy, carmine stylopodium, 1.5 mm long, slightly broader than style, stylopodium and style separated by a distinct abscission layer. *Ovary* spherical to ovoid, 2 mm long, densely villous. *Hypogynous scales* absent. *Fruit* a cylindric, villous achene, 6–7 × 2–5 mm, with a glabrous, black, conical beak terminally; truncate and pedicellate basally with a basal fringe of trichomes (Figure 12).

Diagnostic characters

Serruria rebeloi is easily distinguished by its low, diffuse, sprawling growth habit, secundly arranged, mainly acicular (occasionally 2-, 3-, or 4-furcate) leaves, very small (4–9-flowered) sessile terminal racemes, 10–12 mm

diam., unusually short perianths, 7–8 mm long, straight in bud, and by the absence of hypogynous scales. Moreover, the ovary is surmounted by a cylindric, glabrous, carmine stylopodium, 1.5 mm long from which the style arises, a character that is not known in any other *Serruria*.

Distribution and habitat

This species is confined to the Perdeberg Mountains ± 12 km northwest of Napier in the southern Cape, where it occurs at elevations between 480 m and 600 m, mainly on the Farm Boskloof with additional populations on the adjacent Farms, Fairfield and Perdeberg. On Boskloof there are several populations southwest of Akkedisberg on the watershed of the Uilkraal and Kars Rivers. These populations each consist of several hundred individuals. *Serruria rebeloi* is very localised and is presently not known beyond these sites. It favours gently sloping seasonally moist habitats on Table Mountain Sandstone in Mesic Mountain Fynbos (Figure 13).

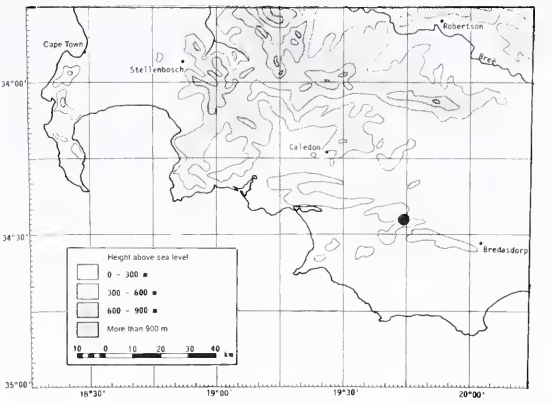

FIGURE 13.—Distribution of *Serruria rebeloi*.

Serruria rebeloi is a seed regenerator that passes through several distinct developmental stages before the adult growth form is attained. In the first three or four years after germinating the seedlings form a compact semi-upright shrublet 150–180 mm tall with densely arranged divided leaves. By the fifth or sixth year, long, lax, trailing stems with secundly arranged leaves begin to develop towards the perimeter of the shrublet (Figure 14). The leaves on these very slender horizontally spreading branches are widely spaced usually with only two or three bifurcations and tend to become simple and undivided towards the growing point. These slender, almost filiform branches continue to develop and spread into the surrounding low fynbos vegetation until the lax, diffuse adult shrublet is about a meter in diameter. Most mature

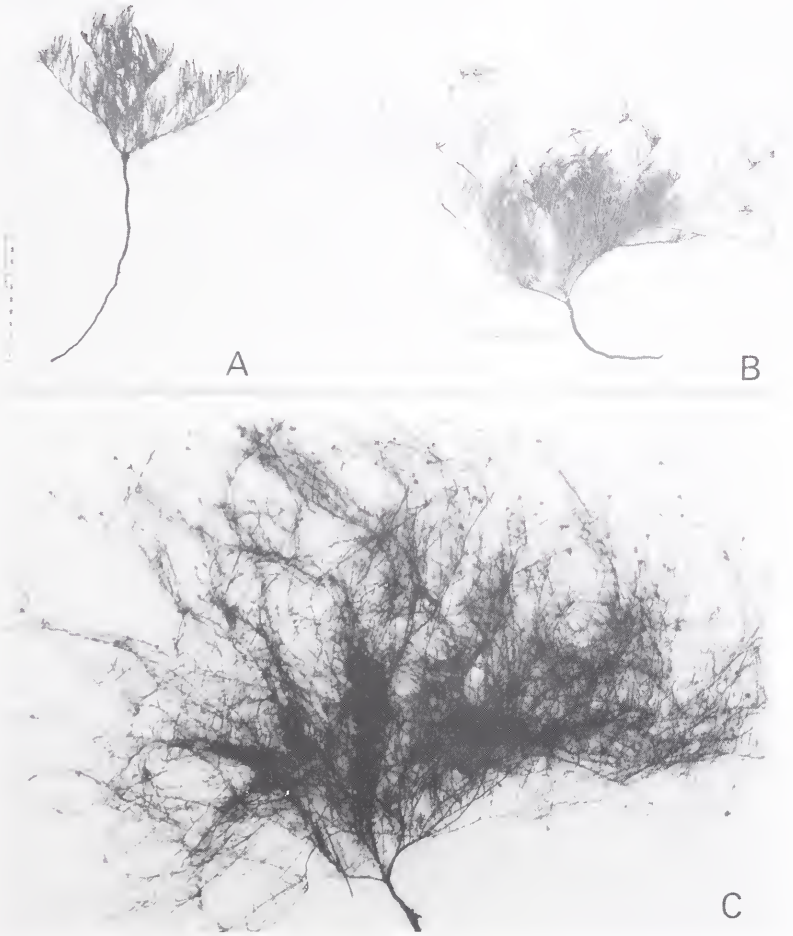

FIGURE 14.—*Serruria rebeloi*, developmental stages from seedling to adult. A, young 2–3-year-old seedling of compact growth; B, ± 5-year-old seedling initiating trailing adult stems with mainly simple undivided leaves; C, fully developed adult shrublet. Part of the type collection, *J.P. Rourke 2151*. Scale bars: 100 mm.

shrublets are so cryptically concealed that they are difficult to observe, even when flowering.

This species is unique in the genus in that each flower sheds its entire style and pollen presenter soon after pollination. An abscission layer develops at the junction of the style base and stylopodium, neatly detaching the style which falls away after pollination, whereafter the ovary and stylopodium continue to develop. The stylopodium enlarges considerably and assumes a deep carmine colour as the fruit continues to swell but later shrivels as the mature fruits are shed in December.

Nothing is known of the pollinators of *S. rebeloi* which are probably small Diptera, Hymenoptera or even ants as the tiny, 4–9-flowered inflorescences are produced almost at ground level. However, the post pollination style-shedding described above, appears to be a pollinator cue to ensure maximum pollinator visitation to unfertilised flowers. An examination of some 50 infructescences revealed an average of one mature fruit per infructescence, indicating a fair degree of pollinator success.

Affinities

Serruria rebeloi appears to be most closely related to *S. deluvialis* Rourke, principally on account of its sessile, very small, few-flowered racemose inflorescences and very short, straight perianths. Like *S. deluvialis* (a widely geographically separated Palmiet River Valley endemic), *S. rebeloi* has a strong tendency to reduce the number of leaf divisions, ultimately producing undivided acicular leaves on the adult shoots. Significantly, in the juvenile stages of the plant's development, the leaves are bipinnate and highly divided but after several years of growth the adult branches produce mainly entire acicular leaves. This tendency to reduce bipinnately divided leaves to entire acicular leaves occurs in other species of *Serruria*, notably *S. simplicifolia* Salisb. ex Knight and appears to be a strongly apomorphic character.

The highly reduced floral characters, reduced leaves and specialised growth habit suggests that *S. rebeloi* is a fairly recently evolved species.

ACKNOWLEDGEMENTS

I am most grateful to Tony Rebelo for drawing my attention to this species and showing me several populations on Boskloof. I would also like to thank Thys de Villiers, a keen amateur botanist and owner of Boskloof for giving me access to his property, for his assistance in collecting fruiting specimens and his hospitality on several occasions. Claire Linder Smith prepared the line drawing.

REFERENCES

ROURKE, J.P. 1990. Four new species of *Serruria* (Proteaceae) from the south-western Cape. *South African Journal of Botany* 56: 497–505.

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Preliminary list of Xhosa plant names from Eastern Cape, South Africa

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Keywords: Eastern Cape, ethnobotany, South Africa, Xhosa plant names

ABSTRACT

1 990 Xhosa names for 1 065 taxa that have been identified in the Selmar Schonland Herbarium and have had names confirmed by more than one source, are listed alphabetically as a further addition to the knowledge of vernacular names of plants for Eastern Cape. Ecological terms are given at the end of the list.

INTRODUCTION

The first list of Xhosa names for plants was compiled in 1917 (Kingon 1917). Subsequently the majority of sources for Xhosa plant names have focussed on traditional healers and medicinal plant names and uses (Sim 1921; Watt & Breyer-Brandwijk 1962; Batten & Bokelmann 1966; Bigalke 1967; Broster 1967; Ndzamela 1970; Vubela 1970; Rose & Jacot Guillarmod 1974; Rose 1979; Lamla 1981; Hutchings 1989; Bhat & Jacobs 1995). Less comprehensive records can be found in historical accounts of the Xhosa people (see Liengme 1983 for references). As yet, these have not been compiled into a single document, although Palmer & Pitman (1972) and Von Breitenbach (1989) have compiled the names of trees from many of these sources. Recently Johnson (1990) has collected and recorded names of trees growing in the former Transkei and discusses the semantics and nomenclature of Xhosa tree names. Broster & Bourn (1981) provide English translations of meanings of plant names derived from uses, religious, spiritual and mythological sources. De Lange (1963) provides names of plants used in cosmetic practices. The current list does not attempt to incorporate the above-mentioned publications as this would be a far too lengthy document and would be impossible to confirm all the names.

METHODS

The unpublished lists of Skead and Rose (both housed in the Selmar Schonland Herbarium, Grahamstown) have been compiled, and further unrecorded names have been added and others confirmed by the present authors.

Skead recorded Xhosa plant names in collaboration with Prof. H. Pahl of the Xhosa Dictionary Unit at Fort Hare University from 1970 to 1986. Field studies were undertaken in the districts of Albany, Bathurst and Port Elizabeth, names were recorded on audio cassette and sent to Pahl for confirmation and the correct spelling applied (C.J. Skead pers. comm.). Plant identifications were done by the Albany Museum Herbarium resulting in a total of 680 names recorded. No voucher specimens were preserved. A number of references were consulted (Sim 1921; Watt & Breyer-Brandwijk 1962; Batten & Bokelmann 1966; Bigalke 1967; Broster 1967; Ndzamela 1970; Vubela 1970; Rose 1979) and names confirmed with Pahl and with field informants. The cassette recordings are housed at the Names Research Institute of the Christian Academy for Tertiary and Secondary Education (CAUSE) in Hatfield, Pretoria (C.J. Skead pers. comm.). The unbound manuscript is archived in the Selmar Schonland Herbarium.

Rose collected plant specimens and recorded Xhosa plant names during an investigation into oesophageal cancer by the Bantu Cancer Research Registry in East London from 1963 to 1980. A herbarium was established in 1963 and was housed in the East London Museum. Field work was undertaken in the following districts: Bizana, Butterworth, Cofimvaba, Engcobo, Kentani, Lusikisiki, Matatiele, Mount Fletcher, Mount Frere, Nqamakwe, Umtata and Willowvale (Gatyana). Xhosa names were confirmed with Prof. H. Pahl of the Xhosa Dictionary Unit at Fort Hare University (E. Rose pers. comm.). 1 200 Xhosa names were recorded and specimen identifications were undertaken at the Albany Museum Herbarium by Jacot Guillarmod and Brink (E. Brink pers. comm.). Voucher specimens are abbreviated as *BCRH* (Bantu Cancer Registry Herbarium), *AJG* (Jacot Guillarmod) and *R&JG* (Rose & Jacot Guillarmod). These are currently housed in the Giffen Herbarium (UFH) at Fort Hare University with some duplicates in the Selmar Schonland Herbarium (GRA). The records of Xhosa names relating to these voucher specimens are housed in the Selmar Schonland Herbarium.

Cocks collected Xhosa names for medicinal plants being traded in Peddie and King William's Town in 1996 (voucher specimens abbreviated as *Cks*) and together with Dold added names of plants used at a household level in rural villages in the same districts (voucher specimens abbreviated as *D&C*). Plants used by communities in and around the Great Fish River Reserve complex for utilitarian purposes, food, medicinal purposes and Xhosa customs were also recorded in 1997 (voucher specimens

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abbreviated as *C&D*). Together these account for a further 117 names recorded and confirmed by means of group discussions in seven rural communities in the former Ciskei. Informal group discussions and semistructured interviews based on Participatory Rural Appraisal (PRA) principles (Chambers 1994; Alexiades 1996; Van Vlaenderen 1996) were undertaken over a two year period (1996–1997) to confirm the names used in this area.

RESULTS AND DISCUSSION

1 990 Xhosa names for 1 065 taxa are listed alphabetically and ten useful ecological terms are given at the end of the list. In some cases two or more Xhosa plant names may be spelled only slightly differently as they are pronounced differently in different dialects and are therefore both included. The use of capital letters to distinguish the prefix from the stem of a word as applied by Batten & Bokelmann (1966) etc., is no longer acceptable practice (Einhorn & Siyengo 1993) except in the case of a proper noun, for example abaThwa (San people).

Descriptive terms indicating plant use or growth form (indicated by †) are often applied and used, for example *iyeza lesisu* means *medicine for the stomach* and refers to *Cyanotis speciosa* (L.f.) Hassk., in the Peddie District. Kingon (1917) and Johnson (1990) discuss the moulding forces for these descriptive names. Some plant names are derived from the Afrikaans language, for example *ibhosisi* is derived from *klein bossie*, meaning little bush in Afrikaans. These are indicated in the text by means of an asterisk (*). Nevertheless these are names that are widely accepted and used by Xhosa speaking people (Einhorn & Siyengo 1993) and are therefore included here. Jennings (1988) provides a clear explanation of the pronunciation of Xhosa words and the characteristic click sounds.

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REFERENCES

ALEXIADES, M.N. (ed.). 1996. *Selected guidelines for ethnobotanical research: a field manual.* New York Botanical Garden, Bronx, New York.

BATTEN, A. & BOKELMANN, H. 1966. *Wild flowers of the eastern Cape Province.* Books of Africa, Cape Town.

BHAT, R.B. & JACOBS, T.V. 1995. Traditional herbal medicine in Transkei. *Journal of Ethnopharmacology* 48: 7–12.

BIGALKE, E.H. 1967. *A list of plants used medicinally in the following districts of Transkei: Bizana, Flagstaff, Libode, Lusikisiki, Qumbu.* East London Museum. Unpublished.

BROSTER, J.A. 1967. *Red Blanket Valley.* Keartland, Johannesburg.

BROSTER, J.A. & BOURN, C.H. 1981. *Amagqirha, religion, magic and medicine in Transkei.* Via Africa, Cape Town.

CHAMBERS R. 1994. Participatory Rural Appraisal (PRA): analysis of experience. *World Development* 22: 1253–1268.

DE LANGE, M. 1963. Some traditional cosmetic practices of the Xhosa. *Annals of the Cape Provincial Museum* 3: 85–95.

EINHORN, E. & SIYENGO, L. 1993. *Xhosa: a concise manual.* College of Careers, Cape Town.

HUTCHINGS, A. 1989. Observations on plant usage in Xhosa and Zulu medicine. *Bothalia* 19: 225–235.

JENNINGS, L.E. 1988. *The concise trilingual pocket dictionary: English, Xhosa, Afrikaans.* Donker, Parklands.

JOHNSON, C.T. 1990. A preliminary checklist of Xhosa names for trees growing in Transkei. *Bothalia* 20: 147–152.

KINGON, J.R.L. 1917. Some place names of Tsolo. *South African Journal of Science* 13: 603–619.

LAMLA, M. 1981. *Traditional healers and their medicine.* Lumko Missiological Institute. Occasional Paper No. 2, Lumko Institute, Cacadu.

LIENGME, C.A. 1983. A survey of ethnobotanical research in southern Africa. *Bothalia* 14: 621–629.

NDZAMELA, A.S. 1970. *List of Xhosa plant names of the Mqanduli district.* Transkeian Department of Forestry and Agriculture, Umtata. Unpublished.

PALMER, E. & PITMAN, N. 1972. *Trees of southern Africa.* Balkema, Cape Town.

ROSE, E.F. 1979. *Xhosa plant names.* Bantu Cancer Research Registry. Botanical Research Unit, Grahamstown. Unpublished.

ROSE, E.F. & JACOT GUILLARMOD A. 1974. Plants gathered as foodstuffs by the Transkeian peoples. *South African Medical Journal* 48: 1688–1690.

SIM, T.R. 1921. Native timbers of South Africa. *Department of Mines and Industries Memoir* No.3. Pretoria.

VAN VLAENDEREN, H. 1996. Working with rural people for development: the use of Participatory Rural Appraisal. *Grassland Society of southern Africa.* Special Publication, 15–18.

VON BREITENBACH, F. 1989. Standard names of trees in southern Africa. Part 6: Xhosa tree names. *Journal of Dendrology* 12: 15–22.

VUBELA, W. 1970. *List of Xhosa plant names of the Grahamstown district.* Albany Museum Herbarium. Unpublished. Selmar Schonland Herbarium, Grahamstown.

WATT, J.M. & BREYER-BRANDWIJK, M.G. 1962. *Medicinal and poisonous plants of southern and eastern Africa,* edn 2. Livingstone, Edinburgh and London.

LIST OF PLANT NAMES AND THEIR XHOSA EQUIVALENT

The list is divided into eight sections: Algae, Bryophyta, Fungi, Lichens, Pteridophyta, Gymnospermae, Angiospermae and ecological terms. Taxa are listed alphabetically within each section. The following abbreviations for collectors names are used: *AJG*, Jacot Guillarmod; *BCRH*, Bantu Cancer Registry Herbarium; *Cks*, Cocks; *C&D*, Cocks & Dold; *D&C*, Dold & Cocks; *R&JG*, Rose & Jacot Guillarmod; *Skd*, Skead. Numbers appearing after these abbreviations refer to the voucher specimen number. †, indicates a descriptive term indicating plant use or growth form. *, indicates a plant name derived from the Afrikaans language.

ALGAE
Fresh water algae, ingubo yesele†, *C&D*
Marine algae, ingca yaselwandle†, *C&D*

BRYOPHYTA
Barbula crinita Schultz, ixolo lamatye†, *BCRH 383*
Bryophyta, ubulembu, *Skd*

FUNGI
Fungi, inkowane, ikhowa, *Skd*
Ganoderma sp., isibindi, *D&C 1745*; umavumbuka, *C&D*
Termitomyces umkowaani (Cooke & Mass.) Reid., ikhowa, *R&JG*

LICHENS
Usnea species and coriaccous lichens, umthafathafa, *Skd*

LICHENS (cont.)
Usnea sp., uboya bemithi†, *BCRH 234*; *AJG 9885*
Parmelia sp., ubulembu belitye†, *Skd*; icuba lamatye†, *BCRH 119*; umthafathafa, *C&D*

PTERIDOPHYTA
Adiantaceae (family), umnambane, *Skd*
Cheilanthes
hastata (L.f.) Kunze, ifense, isisefo, *BCRH 983*
quadripinnata (Forssk.) Kuhn, ifensi, isisefo, *BCRH 983a, 994*; *R&JG*
viridis (Forssk.) Sw., iyeza ledliso†, unomlindana, *Skd*
Cyathea dregei Kunze, isihihi, *Skd*
Marsilea macrocarpa C.Presl, indlebe yebokwe, *Skd*
Pteridium aquilinum (L.) Kuhn, ubende, ubulawu bamagqira†, *BCRH 111*

GYMNOSPERMAE
Cupressus sp., uthulwane, *Skd*
Encephalartos
altensteinii Lehm., umguza, *Skd*; isundu, *R&JG*
sp., umguzani, umngwavu, *Skd*; umphanga, *R&JG*
villosus Lehm., umphanga, umguza, *Skd*
Pinus sp., uthulwana, *Skd*
Podocarpus
falcatus (Thunb.) R.Br. ex Mirb., umsonti, umgeya, umkhoba, umkholeya, umleya, *Skd*; *BCRH 1657*; umngcondo, *R&JG*; *D&C 1750, 1818*
henkelii Stapf ex Dallim. & Jacks., umsonti, *Skd*
latifolius (Thunb.) R.Br. ex Mirb., umgeya, umkhoba, umsonti, umcheya, *Skd*; umkhaba, umkhoba, umcheya, umsonti, *BCRH 215, 236, 1230*; *R&JG*
Stangeria eriopus (Kunze) Baill., umfingwani, umncuma, *Skd*

ANGIOSPERMAE
Abutilon sonneratianum (Cav.) Sweet, ibhosisi* yendlebe, *BCRH 182*
Acacia
caffra (Thunb.) Willd., umngamanzi, *Skd*; umnyamanzi, umthole, *BCRH 453, 896, 1731*
cyclops A.Cunn. ex G.Don, iwintili, *Skd*; iwatile*, *C&D*
karroo Hayne, umngampunzi, intlaka (gum), *Skd*; umnga, *C&D*
mearnsii De Wild., iwatlisi*, idywabasi, *Skd*; *BCRH 436, 915, 1495, 1542, 1601*
robusta Burch., umngampunzi, *R&JG*
Acalypha
glabrata Thunb., umthombothi, *Skd*
peduncularis E.Mey. ex Meisn., isinonya, isityatyisa, iyeza lentshulube†, *BCRH 1135, 1408, 1639*
sp., umanzamnyama, *BCRH 162*
Achyranthes aspera L., isinama sebhokhwe, isanama sokugabha†, isanama, *BCRH 272, 1537*
Acokanthera
oblongifolia (Hochst.) Codd, ubuhlungu, ubuhlungu benyoka, intlungunyembe, *Skd*
oppositifolia (Lam.) Codd, ubuhlungu, ubuhlungu benamba, *Skd*; ubuhlungu bomThwa (medicine belonging to the San people), ubuhlungu benyoka, *BCRH 109, 103, 1226*; intlungunyembe, *D&C 1713*
Acridocarpus natalitius Juss., umabophe, *Skd*
Acrotome inflata Benth., isigagisa, ukakayi, *Skd*; uthekwane, *R&JG*
Adenopodia spicata (E.Mey.) C.Presl, umlungumabele, *Skd*
Agapanthus
africanus (L.) Hoffmanns., isicakathi, *Skd*
campanulatus Leighton, umgwebeleweni, *Skd*
comptonii Leighton, umgwebeleweni, *Skd*
praecox Willd., umgobeleweni, umkhondo, umpofu, *BCRH 1533, 1534*
sp., isihlambeza, *Skd*; umgwebeleweni, umkhondo, *BCRH 601, 815, 1082*
Agathosma apiculata G.Mey., ibhucu, *Skd*
Agave
americana L., iralibhom*, ikhamanga, *BCRH s.n.*; ikhala, *BCRH s.n.*
sp., ikhala, *BCRH 298, 1486*
Agrimonia
eupatoria L., inzinzinaba, inyinga, intshitshi, *Skd*
procera Wallr., unyinge, iyeza lomgqwaliso†, *BCRH 809, 374*
Aizoon glinoides L.f., ucwethekazi, ubushwa, umfanothenkqi, *BCRH 22a, 338, 899*
Alberta magna E.Mey., isiqalana, *Skd*
Albizia adianthifolia (Schumach.) W.Wight, umnebelele, umhlandothi, *Skd*
Albuca
aurea Jacq., intelezi, *BCRH 1680*
setosa Jacq., inqwebeba, *BCRH 1515*
sp., inqwebaba, *Skd*
Alepidea
amatymbica Eckl. & Zeyh., inkatazo, iqwili, *BCRH 583, 992, 992a, 1583, 1643, 1704a, 1758a*; umvuthuza, *C&D*
capensis (P.J.Bergius) R.A.Dyer, inkatazo, *Skd*; iqwili, *BCRH 319*
pilifera Weim., umhlaba, *Skd*
serrata Eckl. & Zeyh., ubulawu, *Skd*
Allium
sativum L., ivimbampunzi, *Skd*
sp., umrateni omhlophe, *BCRH 116*; ikoronofile, *BCRH 120*
Allophyllus
decipiens (Sond.) Radlk., umcandathambo, *Skd*; *R&JG*
melanocarpus (Sond.) Radlk., inqala, *Skd*
natalensis (Sond.) De Winter, umgqalagquzu, *R&JG*
Aloe (generic), ikhalana, ikhala, intelezi, *Skd*
africana Mill., ikhala, *D&C 1696*
arborescens Mill., unomaweni, *BCRH 1223*; ingcelwane, *BCRH 460*
boylei Baker, intelezi, *BCRH 1129*
candelabrum Berger, ikhala, *Skd*
ecklonis Salm-Dyck, ikhala, intelezi, *BCRH 281, 1690*; ingcelwane, *BCRH 1468*; *R&JG*
ferox Mill., umhlaba, ikhala, *Skd*; umhlaba, ingxalaba, *BCRH 221, 1281*; ikhala, *C&D*
maculata All., inocelwane, ingcelwane, *Skd*; ingcelwane, intelezi, *BCRH 14, 1497*; unomaweni, *BCRH 296*
sp., ikhala, ingamdodlo, umhlaba, *Skd*; unomaweni, intelezi, *BCRH 971a, 1467*; imvomvo, *BCRH 294*
tenuior Haw., intelezi, ikhalana, *Skd*; impapane, *R&JG*; umjinqa, *D&C 1507*; *C&D*; umkrakrane, *Cks 8*
Aloysia triphylla (L'Hér.) Britton, umthi wekhokhonathi ioyili†, *BCRH 1210*; ibhosisi*, *BCRH 180*
Amaranthus
blitoides S.Watson, unomdlobhoyi, *Skd*
caudatus L., utyuthu, *BCRH 448*
deflexus L., unomdlobhoyi, *BCRH 880*; utyuthu, *BCRH 910*
hybridus L., unomdlobhoyi, umtyutyu, umambomba, utyuthu, *Skd*; imbuya, umambumbu, unomdlombhoyi, utyuthu obomvu, utyuthu, imbuya, usihlwabitshi, imifino, ujikenxaniwe, *BCRH 167, 168, 728, 1195*
sp., ujikenxaniwe, utyutu, *BCRH 957*; inkanga, *C&D*
spinosus L. imbuya, *Skd*; *BCRH 21a*
thunbergii Moq., inoleboyi, uqupose, *Skd*; umambumbu, ujikenxaniwe, *BCRH 1196, 1547, 1614*
Anacampseros ustulata E.Mey ex Sond., igwele, *Skd*
Anagallis arvensis L., umsolo, *BCRH 768*
Anastrabe integerrima E.Mey. ex Benth., isiphambatho, *Skd*
Andrachne ovalis (Sond.) Müll.Arg., umbezo, *Skd*
Androcymbium longipes Baker, inokam, *BCRH 1672*
Andropogon sp., isifikana, *Skd*
Anemone
caffra Eckl. & Zeyh., iyeza elimnyama†, *Skd*
tenuifolia (L.f.) DC., uxhobakhulu, irododo, amanzamnyama, *BCRH 984, 984a, 1198, 1236, 1581, 1596*
Anthospermum aethiopicum L., umthi wamaqhakuva†, umsantsana, *BCRH 1598*
Antidesma venosum E.Mey. ex Tul., umtyongi, *Skd*
Apium graveolens L., isupu, *BCRH 1605*
Apodytes dimidiata E.Mey. ex Arn., umdakana, umdakane, *Skd*; *R&JG*
Aptenia cordifolia (L.f.) Schwantes, intelezi, *BCRH 1098*
Arachis hypogaea L., indongomane, *BCRH 389*
Araujia sericifera Brot., impinda, *BCRH 722*
Arctotheca calendula (L.) Levyns, isiqwashumbe, *BCRH 1321*
Arctotis arctotoides (L.f.) O.Hoffm., ubushwa, *BCRH 849, 850, 1430*; *D&C 1512*; *Cks 12*; isigwamba *C&D*; *Cks 23*
Argemone ochroleuca Sweet, ikritsi, *BCRH 118, 818*
Argyrolobium sp., umfanujacile, *BCRH 217, 218*
Aristida junciformis Trin. & Rupr., umgogoni, *Skd*
Artemisia afra Jacq. ex Willd., umhlonyane, *Skd*; umhlonyane womlambo†, umhlonyane omhlophe, *BCRH 2, 141, 433, 752, 1220, 1273, 1555*; umhlonyana, *C&D*
Asclepiadaceae (family), ubungxani, *Skd*; isiqaji, *BCRH 1573, 1635*
Asclepias
crispa P.J.Bergius, umtshekisane, *R&JG*
fruticosa L., ukakhayi, *Skd*; igwada, *D&C 1835*
gibba (E.Mey.) Schltr., umqhaphu, igontsi, unyawo lwenkukhu, *BCRH 173, 283, 1263, 1567*

Asclepias (cont.)
multicaulis (E.Mey.) Schltr., unyawo lwenkukhu, *BCRH 1170*
Asparagus
africanus Lam., ubulawu obumhlope, umthunzi, *Skd*; ivane, umdumizulu ibangana, *BCRH*; umathunga, *Cks 3*; *C&D*
falcatus L., ubulawu, *BCRH 406*
macowanii Baker, umvithi, *BCRH 109*
racemosus Willd., ivane, *R&JG*
sp., ikubalo, ingcelwane, itali, umvane, *Skd*
stipulaceus Lam., umvane, *Skd*
suaveolens Burch., imvane, *Skd*; imvane, incetha, ingcatha, *BCRH 399, 759*
Aspidoglossum heterophyllum E.Mey., isikhonde, *R&JG*
Aster bakeranus Burtt Davy ex C.A.Sm., unozixekana, umtshekisana, unogxekana, *Skd*; unosendana, uxekana, *BCRH 119*; unozidehekana, *BCRH 120*; iyeza lentshulube†, *BCRH 174*; inkanga, *D&C*
Asteraceae (as a family), ubulawu, *Skd*
Athrixia heterophylla (Thunb.) Less., iyeza logezo†, *Skd*
Avena sativa L., ihabile, *BCRH 393*
Avicennia marina (Forssk.) Vierh., isikungati, *Skd*
Azima tetracantha Lam., igcegceleya, igceya, *Skd*; igcegceleya, *Cks 6*; *C&D*
Baphia racemosa (Hochst.) Baker, itshupu, isifithi, *Skd*
Barleria sp., inzinziniba, *BCRH s.n.*
Bartsia trixago L., utseweletswele, *Skd*; *BCRH 987, 1375*
Becium burchellianum (Benth.) N.E.Br., ibhubhusi, *Cks 16*; *C&D*
Begonia sutherlandii Hook.f., inomaweni, *BCRH 1633*
Behnia reticulata (Thunb.) Didr., umatapile*, *BCRH 197*; isilawu, *D&C 1756*; izihlwele, *D&C 1816*
Berchemia zeyheri (Sond.) Grubov, umini, *Skd*
Berkheya
carduoides (Less.) Hutch., ikhakhaka, ikhakhakhaka, *BCRH 362*; ikhakhakhaka lomlambo†, *BCRH 422*
decurrens (Thunb.) Willd., ikhakhakhaka elikhulu, iganashane, *Skd*
setifera DC., indlebe yenkomo, *Skd*; iyeza lesisu xa umfazi ekhulelwe†, *BCRH 1145, 1579*
sp., ikhakhakhaka, ikhambi lembelekisana, *BCRH 82, 392, 746, s.n.*; ikhakhakhaka, *C&D*
Bersama
lucens (Hochst.) Szyszyl., isindiyandiya, *Skd*; *BCRH 1627*
swinnyi E.Phillips, isindiyandiya, *Skd*
tysoniana Oliv., indiyaza, isindiyandiya, *Skd*; isindiyandiya, isibhara, isindiyandiya, *BCRH 651, 1471, 1707a*
Berula erecta (Hudson) Coville subsp. *thunbergii* (DC.) B.L.Burtt, ucaphazana, *BCRH 1744*
Bidens
bipinnata L., ugcadolo, exhomiseyile, *BCRH 1369, 1370*
pilosa L., ugcadolo, umhlabangubo, imbikicane, *Skd*; uladolo, *BCRH 731, 735*; ugcadolo, umhlabangubo, *BCRH 36, 38, 149, 149b, 828, 1149a, 1228, 1317, 1353, 1386, 1387, 1433, 1616*
Blepharis capensis (L.f.) Pers., ubuhlungu besigcawu, *Skd*; unomatshinotshino, *BCRH 359*
Blumea alata (D.Don) DC., ubuhlungu bomlambo†, *BCRH 110*
Boophane disticha (L.f.) Herb., inswadi, *Skd*; ishwadi, *D&C s.n.*
Boscia
albitrunca (Burch.) Gilg & Benedict, umgqomogqomo, *Skd*
oleoides (Burch. ex DC.) Toelken, umphunzisa, *Skd*; umabophe, umphunzisa, umgqamagqama, *BCRH 95*; ivetirati*, *D&C 1669*; *C&D*
Bowiea volubilis Harv. ex Hook.f., umaqana, *Skd*; umagaqana, *BCRH 157, 985, 985a*
Brachylaena
discolor DC., umpahla, *Skd*; umpatha, isiduli, *BCRH 1112*
elliptica (Thunb.) DC., isiduli, *Skd*; isagqeba, *Cks 15*
glabra (L.f.) Druce, amacirha, *BCRH 1599*
ilicifolia (Lam.) E.Phillips & Schweick., umgqeba, *R&JG*; *D&C 1504*; *C&D*
sp., isiduli, *Skd*
Bridelia micrantha (Hochst.) Baill., umhlalamakwaba, *Skd*
Bruguiera gymnorrhiza (L.) Lam., isiqungati, isikungati, *Skd*
Brunsvigia gregaria R.A.Dyer, ikunzi emhlope, *Skd*; ishwadi, *BCRH 1083*
Bryophyllum delagoense (Eckl. & Zeyh.) Schinz, intelezi yobushwa, *BCRH 441*
Buddleja
auriculata Benth., utile, *BCRH 1309*
dysophylla (Benth.) Radlk., umhlabangubo, *BCRH 371*
saligna Willd., igqange, *Skd*
salviifolia (L.) Lam., ilotana, igwangi, ilotyane, igqange, icwanci, icwangi, *Skd*; igqange, *R&JG*
Bulbine
abyssinica A.Rich., iyeza lipulayiti†, *Skd*; utswelana, *R&JG*; uyakayakana, *D&C 1510*; *C&D*
alooides (L.) Willd., ingcelwane, Skd; irooiwater*, *D&C 1509*; umanzambomvu, *C&D*
asphodeloides (L.) Willd., itswele lenyoka, iyeza lehashe†, umthi kanomyayi†, itswelemyoka, intelezi, *Skd*; uyakayakane, utsweleni, utswelana, utswelane, intotyane, *BCRH s.n., 113, 1159*; *R&JG*; uyakayakayana, *C&D*; uyakayakana, *Cks 14*; irooiwater*, *Cks 18*
capitata Poelln., itswelana, *BCRH 843*
frutescens (L.) Willd., itswele lenyoka, *BCRH 953*; utswelana, *BCRH 308*
latifolia (L.f.) Roem. & Schult., ibucu, ingcelwane, *Skd*; ibucu, *BCRH 875*
narcissifolia Salm-Dyck, umalala, *BCRH 16, 55*
sp., utswelana, *BCRH 1078*
Burchellia bubalina (L.f.) Sims, utobankomo, itobancane, umfincane wehlati†, intsizi ezimayama, ithobankomo, umfincafincane, ubuhlungu benyoka, *Skd*; umfincafincane wehlathi†, umsombutyu, usomutyu, *R&JG*
Buxus
macowanii Oliv., umgalagala, *Skd*; *R&JG*
natalensis (Oliv.) Hutch., umgalagala, ukuxeka, *Skd*; isixeza, *R&JG*
Cadaba aphylla (Thunb.) Wild, usitorhom*, *D&C 1672*; *C&D*
Caesalpinia
decapetala (Roth) Alston, ubobo, *BCRH 1299, 1411, 1740*
pulcherrima (L.) Schwartz, ubobo, *BCRH 1571*
Calendula officinalis L., ibhosisi*, *BCRH 470*
Calodendrum capense (L.f.) Thunb., umbaba, umsitshana, *Skd*; umbatha, umbaba, umemezi, *BCRH 201, 604*
Calopsis paniculata (Rottb.) Desv., umtshayelo†, *R&JG*
Calpurnia
aurea (Aiton) Benth. subsp. *sylvatica* (Burch.) Brummitt, umdloli, *Skd*; umbethe, *BCRH 140, 862*; *D&C 1693, 1755*
glabrata Brummitt, idywadi, *Skd*; umbethe, undlole, *R&JG*
sp., umsiphane, *Skd*; umbethe, *R&JG*
Canna indica L., unomatananga, *BCRH 1498*
Cannabis sativa L., umva, isangu, *Skd*; umya, intsangu, indara*, ingca, *BCRH 1242*
Canthium (generic), umnyushulube, *Skd*
ciliatum (Klotzsch) Kuntze, ubuchopho, umdakana, umnyushulube, *BCRH 766, 1407*
inerme (L.f.) Kuntze, umvuthwamimi, *Skd*; umnyushulube, *R&JG*; isiphingo, *D&C 1744*
kuntzeanum Bridson, ubuchopho, *Skd*
mundianum Cham. & Schltdl., undilambele, *Skd*; irarinathi, *BCRH 277*
spinosum (Klotzsch ex Eckl. & Zeyh.) Kuntze, isiphambatho, *Skd*
Capparis
fascicularis DC., amabinda, *D&C 1714*; iqhagula, *C&D*
sepiaria L. var. *citrifolia* (Lam.) Toelken, uqapula, intshilo, upasmani, intshilo, umqagula, *Skd*; intsihlo, *BCRH 64, 600*; isihlo esimbomvu, *D&C 1721*; iqaphula, *D&C 1683*; imfihlo, *D&C 1695*; intsihlo, *C&D*
tomentosa Lam., imfihlo, intsihlo, *Skd*
Capsicum
annuum L., itshilisi*, ikhanakhana, *BCRH 121*
sp., ikhanakhana, *BCRH 720*
Carex mossii Nelmes, imfeyesele, *BCRH 248*
Carissa
bispinosa (L.) Desf. ex Brenan, ibethamtunzi, isivusankunzi, *Skd*; isabetha nkunzi, *BCRH 210, 1514*; *R&JG*; isabetha, *D&C 1757*; incumncum, *D&C*
haematocarpa (Eckl.) A.DC., isivusankunzi, umthungulu, *Skd*; incumncum, *R&JG*
macrocarpa (Eckl.) A.DC., umthungulu, *R&JG*
Carpobrotus
deliciosus (L.Bolus) L.Bolus, igcuthuma, *Skd*
edulis (L.) L.Bolus, unomatyumtyum, *BCRH 263*; igcukuma, *C&D*
Cassine
aethiopica Thunb., umnqayi, umgxube, *Skd*; umbomvane, umbovu, iyeza lokugabha†, *BCRH 1110, 1660, 1660a, 1702a*
peragua L. subsp. *peragua*, umbomvane, *Skd*; *BCRH 458*
Cassinopsis
ilicifolia (Hochst.) Kuntze, igcegceleya, *Skd*; ukhovothi, *R&JG*
tinifolia Harv., uluhlaza, *Skd*

Cassipourea flanaganii (Schinz) Alston., umemezi, *D&C 1743*; *C&D*
Catha edulis (Vahl) Forssk. ex Endl., umhlwazi, igqwakra, *Skd*
Celtis africana Burm.f., umvumvu, *Skd*; umnonono, umvumvu, imvumvu, *BCRH 117, 255, 499*; *R&JG*
Centaurea sp., ifinifini, *BCRH 274*; imvomvo, *C&D*
Centella
coriacea Nannfd., inyongwane, unongotyozana, *Skd*; umsolo, unonyongwana, unonyongwane, unyongwane, unongotyozana, ibhekalanga, unyongwana, *BCRH 153, 154a, 1156, 1373, 1566, s.n.*
eriantha (Rich.) Drude, unongotyozane, inongwane, *BCRH 1426*
sp., inyongwane, *BCRH 776*; iphuzi, *C&D*
Cephalaria
decurrens (Thunb.) Roem. & Schult., umtotova, *Skd*
oblongifolia (Kuntze) Szabó, iyeza lesisu†, *BCRH 1428*
Chaetacanthus setiger (Pers.) Lindl., umsolo, *BCRH 427, 1178*
Chaetacme
aristata Planch., umkovoti, umkoboti, *Skd*
sp., umkombota, *Skd*
Chamaecrista
capensis (Thunb.) E.Mey., unobuthongwana, umgana, *BCRH 365*; *R&JG*
mimosoides (L.) Greene, umnyana, umngana, unobuthongwana, *Skd*
Chamaesyce inaequilatera (Sond.) Soják, ibhosisi*, *BCRH 139*
Chenopodium
album L., imbikicane, iphunga, *Skd*; imbikicane, *BCRH 1709*; umfanuthenqi, ihobe, imbuya, imbikicane embomvu, *BCRH 34, 35, 262, 342, 381, 410, 713, 714, 942, 943, 944, 1352, 1676*
ambrosioides L., umangalisa, umhlahlapethu, umbikicane, *Skd*; imboya, *BCRH 1441*; undihlabulele, *BCRH 1297*; unukayo, iyeza lencukuthu†, iyeza lomoya†, *BCRH 166, 918*
mucronatum Thunb., imbikicane, *BCRH 381*
murale L., umfanuthenkqi, *Skd*; umbikicane, isisinisekati, umfanuthenkqi, isisinyisekathi, *BCRH 34a*; lihobe, imbikicane, *BCRH 1347*; umfanoqinile, *BCRH 1351*
sp., umkhamelo, *BCRH 133*; ispilingishi, *BCRH 1328*; umbuyabatwa, *BCRH 1301*; umfanathenkqi, imbikicane, *BCRH 262, 1165, 1695*
Chionanthus foveolatus (E.Mey.) Stearn, umqumaswele, umdlebe, *Skd*; isiduli, *R&JG*
Chloris virgata Sw., itlhaga, umadolwana, *Skd*
Chlorophytum
comosum (Thunb.) Jacq., ujejane, ujiyane, *Skd*; ubuhlungu bomlambo†, *BCRH 107*; ujejane, isicakathi, *BCRH 233*; *AJG 4884*
sp., isicakathi, *BCRH 778*
Choristylis rhamnoides Harv., intendekwane, *BCRH 642*
Chrysanthemoides monilifera (L.) Norl., ulwamfithi, ilamfithi, *R&JG*
Chrysocoma ciliata L., ibhosisi*, *BCRH 179, 894*
Cirsium vulgare (Savi) Ten., ikhakhakhaka, *Skd*; *BCRH 892*; *C&D*
Cissampelos
capensis L.f., umayisake, *D&C 1678, 1712*; idabulitye, *C&D*
torulosa E.Mey. ex Harv., umayisake, isitorhom sehlathi†, isitorhom, *BCRH 245, 269*
Citrullus lanatus (Thunb.) Matsum. & Nakai, umxoxozi, *BCRH 848, 1469*
Clausena anisata (Willd.) Hook.f. ex Benth., umnukambile, umtuto, umnukambiba, isifuta, umfuto, isifutu, *Skd*; isifutho, *BCRH 73, 247, 256, 501, 873, 1333, 1472, 1658*; *R&JG*; iperepes*, *D&C 1689*; isiqhumiso, *C&D*
Clematis brachiata Thunb., ityholo, *Skd*; umvuthuza, *BCRH 1478, 1550*; *R&JG*; ityholo, *D&C 1821*; umvuthuza, ingolwane, *C&D*
Clerodendrum glabrum E.Mey., uluvethe, umqwaqwanam, umqwaqu, umqangazani, *Skd*; uqangazane, *R&JG*
Cliffortia
linearifolia Eckl. & Zeyh., unwele, *R&JG*
sp., umnwele, *Skd*
strobilifera Murray, umnwele, umgwele, *Skd*
Clivia sp., ugobeleweni, *BCRH 774*
Clutia
heterophylla Thunb., incega, umbumbu omncinci, ungqengendlelo, ubuhlungu bedila, umoto, *Skd*; ingcili, *BCRH 432*; umsolo, *BCRH 1152*
pulchella L., umsiphane, umthungwa, uqadi, umkhondo, umfiyo, umbumbu, *Skd*; umkhwinti, umbheso, ubushwa bamehlo, *R&JG*
sp., umbezo, umbethu, *Skd*
Coccinia
quinqueloba (Thunb.) Cogn., ithangazana, *Skd*; ufokwe, *BCRH 773*
sessilifolia (Sond.) Cogn., ifokwe, *BCRH 912*
Coddia rudis (E.Mey. ex Harv.) Verdc., intsinde, *Skd*; umgxube, *C&D*
Cola natalensis Oliv., umtenenenda, *Skd*
Colocasia esculenta (L.) Schott, idumbe, *BCRH 1568*
Colpoon compressum P.J.Bergius, umbulunyathi, intekaza, *Skd*
Combretum
bracteosum (Hochst.) Brandis ex Engl., uqota, uqoto, *Skd*
caffrum (Eckl. & Zeyh.) Kuntze, umdubu, *Skd*; *R&JG*
erythrophyllum (Burch.) Sond., umdubu, umdubo, *Skd*
kraussii Hochst., umdubu wehlathi†, ulandile, *Skd*
sp. umdubi, *Skd*
Commelina
africana L., igqwanatya, *BCRH 388*; idwabane, isicakathi, *BCRH 1401*; umbethe, *BCRH 1527*
benghalensis L., uhlotshane, *Skd*; isilalambethe, *BCRH 1400*
erecta L., umadolwana, *BCRH 844*
Conmiphora
harveyi (Engl.) Engl., umhlunguthi, *Skd*
mossambicensis (Oliv.) Engl., umdono, *Skd*
sp., umhlunguthi, *Skd*
woodii Engl., umhlunguthi, *Skd*; ulonwabo, *BCRH 1667*
Conostomium natalense (Hochst.) Bremek., unomashwa, *BCRH 1516*
Convolvulus
capensis Burm.f., uvuma omhlophe, *R&JG*
farinosus L., inabulele, *Skd*; uboqo, usinga lamaxhegwazana, inabulele, uboqo wabadlezana, *BCRH 913*
natalensis Bernh. apud Krauss, uboqo, *BCRH 1173*
sagittatus Thunb., uboqo wabadlezana, ubokwe, *BCRH 209, 868*
sp., ubhoqo, ubhoqom, *Skd*
Conyza
bonariensis (L.) Cronquist, umvawamadoda, *BCRH 428*
canadensis (L.) Cronquist, unonkangana, *Skd*; umvawamadoda, *BCRH 1127*
obscura DC., ubuhlungu beramba, *BCRH 1510*
pinnata (L.f.) Kuntze, ubuhlungu beramba, *R&JG*
scabrida DC., isavu, *Skd*; umfazi unengxolo, unonkangana, ingcethe, icegceya, isavu, iyeza lomoya†, *BCRH 137, 317, 454, 887*; *R&JG*
sp., iyeza lomoya†, *BCRH 744*; inkanga, iyeza lamadoda†, *BCRH 378, 1436, 1525, 1691*
Cordia caffra Sond., umnofunofu, umnovunovu, umluvuluvu, umlovulovu, *Skd*
Coronopus didymus (L.) Sm., unondlwabiyele, *Skd*; *BCRH 18a*
Cotula
anthemoides L., umhlonyane, *Skd*; unochwayi, indlwabulele, unolabulele, *BCRH 715, 733, 1742*
heterocarpa DC., unondlabiyele, unomayepuyepu, *Skd*; unochwayi, undlwabiyela, ihlanangobo, indlwabiyelo, *BCRH 286, 1064, 1397*; *R&JG*
sp., itigiliti, *R&JG*
Cotyledon
orbiculata L., iphewula, *Skd*; *BCRH 99, 902*
sp., iphewula, *Skd*; isundu, *C&D*
Crabbea
hirsuta Harv., umanxasana, *Skd*; umsobo wegusha, *BCRH 835*
nana Nees, ubuhlungu besigcawu, *Skd*; iyeza lomkhondo†, *BCRH 1619*; umsobo wegusha, *BCRH 1549*
Crassula
pellucida L., subsp. *marginalis* (Dryand. in Aiton) Toelken, inyamayamakhwenkwe, *BCRH 243*; *AJG 4895*
sp., iphewula, *Skd*; *BCRH 98*; intelezi, *BCRH 978*
spathulata Thunb., uguwe, *BCRH 1531*
vaginata Eckl. & Zeyh., uphuncuka bemphethe obomvu, ipewula lethafa†, uphuncuka bemphete, *BCRH 416, 1541*
Crataegus sp., isacephe, *BCRH 1692*
Crinum sp., ibhucu, *BCRH 1466*
Crotalaria
agatiflora Schweinf., umthi wentaka, *BCRH 467*
capensis Jacq., ihlolo getyane, *BCRH s.n.*
Croton sylvaticus Hochst., umgwaqane, umagwaqane, umfeze, *Skd*
Cryptocarya
latifolia Sond., umthungwa, *Skd*
myrtifolia Stapf, umthungwa, umthungwane, *Skd*
woodii Engl., umthungwa, *Skd*; umasendenja, umnqayimasende, isithungu, *R&JG*; umnquma, *D&C 1815*
wyliei Stapf, inqayana, *Skd*
Cucumis africanus L.f., ithangazana, *Skd*; ithangazana lethafa†, *BCRH 230*
Cucurbita
pepo L., usenga, imithwane, *BCRH 1631*
sp., imithwane yasendle, *BCRH 1545*

Cucurbitaceae, utyampentyu, ujodo, amasuntsu, intshungu, *BCRH 1305, 1314, 1371*; ubece, *BCRH 1346*; iselwa lwentaka, *BCRH 1530*; umadliwa kuhlinzwa, *BCRH 652*
Cunonia capensis L., umqwashube, *Skd*; umrhwaxube, igqwakra, *BCRH 207*
Curtisia dentata (Burm.f.) C.A.Sm., uzintlwa, umgxina, umdlebe, *Skd*; umgxina, umlahleni selefile, umlahleni, isirayi, *R&JG*; umlahleni, *D&C 1819*
Cussonia
paniculata Eckl. & Zeyh., igcokhwe, *Skd*; umsenge, *BCRH 69, 371, 959*; umsenge, *C&D*
spicata Thunb., intsenge, umgezisa, *Skd*; umsenge, umsange, *BCRH 15, 719, 1485*; umsenge, *D&C 1709, 1741*
Cyanella lutea L.f., izambhalo zokugqubhuza, *Skd*
Cyanotis speciosa (L.f.) Hassk., umagoswana, *Skd*; umadolwana, iyeza lesisu†, *BCRH 316, 958*
Cyathula
cylindrica Moq., isinama esikhulu, *BCRH 1564*
uncinulata (Schrad.) Schinz, isinama, *Skd*; isinama esikhulu, *BCRH 916, 1384*; isinama, *BCRH 1383*
Cycnium racemosum Benth., injanga, *Skd*
Cymbopogon
excavatus (Hochst.) Stapf ex Burtt Davy, umqungu, *Skd*
marginatus (Steud.) Stapf ex Burtt Davy, umqungu, *Skd*; *BCRH 1722*
plurinodis (Stapf) Stapf ex Burtt Davy, umbete, ingca, *BCRH 1197*
validus (Stapf) Stapf ex Burtt Davy, umqungu, *Skd*; umvethi, *BCRH 1558*
Cynanchum
obtusifolium L.f., uluzi, *D&C s.n.*
sp., itangazana lenja, *Skd*; unombija, *R&JG*
Cynodon
dactylon (L.) Pers., uqaqaqa, *Skd*; *BCRH 213*
incompletus Nees, uqaqaqa, *R&JG*
Cynoglossum lanceolatum Forssk., isinama esincici, *BCRH 871*
Cyperus
esculentus L., inqoba, *Skd*
fastigiatus Rottb., inqoboka, *Skd*
marginatus Thunb., incema, *Skd*
pulcher Thunb., urhwantsi, *Skd*; indawa, *BCRH 279*; urhwantsana, indawa, *BCRH 279*
sexangularis Nees., urhwantsi, *Skd*
sp., imishi, imizi, indawa, *Skd*; ixonya, *C&D*
textilis Thunb., ingculu, umzi, *Skd*; urhwantsi, umzi, *BCRH 917, 1418*; imizi, *BCRH 89*; *AJG 73*
Cyphia
assimilis Sond., igontsi, *Skd*
volubilis (Burm.f.) Willd., igontsi, *Skd*
Cyphostemma cirrhosum (Thunb.) Descoings ex Wild & R.B.Drumm., intoyomntwana, *BCRH 372, 1484*
Cyrtanthus
contractus N.E.Br., umtetebu, *BCRH 1293*
obliquus (L.f.) Aiton, umkhondo, *BCRH 1081*
Cyrtorchis arcuata (Lindl.) Schltr., iphamba, *D&C 1747*
Dais cotinifolia L., intozane, *Skd*
Dalbergia
armata E.Mey., umqokolo, ubobo, *Skd*
obovata E.Mey., umzungulu, *Skd*
Datura
sp., ingqangangqanga, isingiliti, isitingibawuthi, *BCRH 462*
stramonium L., umvumbengwe, umhlavuthwa, *Skd*; impungempu, ingqangangqanga, uvumbangwe, ibhudabhutha, umvumbangwe, ivumbangwe, *BCRH 822, 1208, 1218, 1522*
Deinbollia oblongifolia (E.Mey. ex Arn.) Radlk., umasibele, umbangabanga, *Skd*
Delosperma sp., intelezi, *BCRH 977*
Dianthus thunbergii Hooper, ungcana, ubulawu, ubulawu obumhlophe, *BCRH 465, 1241*; inkomoyentaba, *D&C 1719*; ungcana, *D&C 1810*; indlela zimhlope, *C&D*
Diclis reptans Benth., umamtola, isala lentaka, *BCRH 1427, 1539*
Dicoma
anomala Sond., unyongwane, *BCRH 1211*
zeyheri Sond., umqele, umlunge, *Skd*
Dierama pendulum (L.f.) Baker, ithembu, *R&JG*
Dietes iridioides (L.) Sweet ex Klatt, imbotyi kaxam, *R&JG*
Digitaria
eriantha Steud., injica, inzica *Skd*; injica, *R&JG*
sanguinalis (L.) Scop., umadolwana, *Skd*
Dioscorea
cotinifolia Kunth, umtane, *Skd*
dregeana (Kunth) T.Durand & Schinz, ingcolo, *Skd*
rupicola Kunth, usikolipati*, *BCRH 1209, 1422, 1546*
sp., ingcolo, *BCRH 70*
sylvatica (Kunth) Eckl., usikolipati*, *BCRH 130, 723, 1092, 1423*; *Cks 5*
Diospyros
austro-africana De Winter, umbongisa, *Skd*
dichrophylla (Gand.) De Winter, umbongisa, *BCRH s.n.*
lycioides Desf., umbongisa, *Skd*
natalensis (Harv.) Brenan, intshikivane, umtyshone, *Skd*
pallens (Thunb.) F.White, umbongisa, *BCRH 1688*; *R&JG*
simii (Kuntze) De Winter, umbongisa, *Skd*
sp., umbangaza, *BCRH s.n.*
villosa (L.) De Winter, inyamempunzi, unoboyana, *Skd*
whyteana (Hiern) F.White, umkhaza, umbongisa, umgugunga, umtenatene, intsanzimane, *Skd*; umkhaza, *R&JG*
Dombeya
cymosa Harv., uzingathi, *Skd*
tiliacea (Endl.) Planch., ityibo, *Skd*
Dovyalis
caffra (Hook.f. & Harv.) Hook.f., incagolo, umqokolo, *Skd*; *BCRH 1308, 1641*
lucida Sim, umqokolo, *Skd*
rhamnoides (Burch. ex DC.) Harv., umqokolo, *Skd*
rotundifolia (Thunb.) Thunb. & Harv., umqokolo, *Skd*
zeyheri (Sond.) Warb., umqokolo, *Skd*
Dracaena
aletriformis (Haw.) Bos, intelezi, *D&C 1762*
hookeriana K.Koch, ishwadi, *BCRH 171*
Drimia
anomala (Baker) Benth., ungcana, *C&D*
sp., unopilikoko, unojijwa *Skd*; umangolwane, *C&D*
Dryopteris athamantica (Kuntze) Kuntze, umkhomokhomo, *Skd*
Drypetes
arguta (Müll.Arg.) Hutch., ilitwakela, umhlagela, umhlangela, *Skd*
natalensis (Harv.) Hutch., umkiwane, *Skd*
Duvernoia adhatodoides E.Mey. ex Nees., isipheka, ihlehlwe, *Skd*
Ehretia rigida (Thunb.) Druce, umhleli, ungobogobana, umbotshani, umbotshane, *Skd;* umhleli, *R&JG*; *C&D*
Ekebergia capensis Sparrm., umnyamati, umgwenye wezinja, *Skd*; umgwenye, umgwenyobomvu, umlahleni selefile, umanaye, *BCRH 429, 1121, 1122, 1457*; *R&JG*
Elaeodendron croceum (Thunb.) DC., umbomvane *Skd*; *BCRH 123, 775*; *R&JG*; *D&C 1812*
Elephantorrhiza elephantina (Burch.) Skeels, intolwane, *Skd*; intololwanana, incakotshi, indololwane, *BCRH 208, 1136, 1569*
Eleusine coracana (L.) Gaertn. subsp. *africana* (K.-O'Byrne) Hilu & De Wet, umshala wesandla, isihlati senja, isisini sekati, *BCRH 1540*
Elytropappus rhinocerotis (L.f.) Less., ibhubhusi*, ibhobhosi*, *Skd*
Emex australis Steinh., idolo lenkonyana, inkunzane, *Skd*
Englerodaphne
pilosa Burtt Davy, intozane, *R&JG*
sp., unomanumbane, *BCRH 438*
subcordata (Meisn.) Engl., intozani, *Skd*
Englerophytum natalense (Sond.) T.D.Penn., umtongwani, ithunga, umthungwane, *Skd*
Eragrostis
plana Nees, umtshiki, *Skd*
tef (Zucc.) Trotter, ifidi lwenkomo, *BCRH 1233*
Erianthemum dregei (Eckl. & Zeyh.) Tiegh., iduma, *Skd*
Eriosema
kraussiana Meisn., umthi, *BCRH 1591*
parviflorum E.Mey., iyeza lemimoya emibi†, *BCRH 1477*
squarrosum (Thunb.) Walp., umbangalala, *R&JG*
Eriospermum sp., intelezi, *BCRH s.n.*; isikelem*, ungunoma, *BCRH 742, s.n.*; unonyada, *C&D*
Erythrina
acanthocarpa E.Mey., utambuki; isintsana, *BCRH 63, 190, 229*
caffra Thunb., umsintsi, *Skd*
humeana Spreng., umintsane, utambuki, umsintsane, *Skd*
latissima E.Mey., umnqwane, umkuwane, *Skd*; umgwane, umsintsi, *BCRH s.n.*
lysistemon Hutch., umkloka, *Skd*; umsintsi, *BCRH s.n.*
sp., umsintsi, *BCRH 1505*
Erythroxylum emarginatum Thonn., itimani, *Skd*
Euclea
crispa (Thunb.) Guerke, iyeza lokuxaxuzisa†, umgwali, umgwari, *Skd*; umnquma, *BCRH 90*
divinorum Hiern, umtshekisane, *Skd*

Euclea (cont.)
lancea Thunb., umgwali, *Skd*
natalensis A.DC., umtshekesane, umtshekisane, umkaza, umgwali, *Skd*; intlakotshane enkulu, umtshekisane, *BCRH 1414*; *R&JG*; umtshekisana, *BCRH 817*
schimperi (A.DC.) Dandy, umkaza, *Skd*
sp., umtshekisane, *Skd*
undulata Thunb., umgwali, umgwari, *Skd*
Eucomis
autumnalis (Mill.) Chitt., ubuhlungu bechanti, *Skd*; isithithibala esimathunzi, *BCRH 1203*
comosa (Houtt.) Wehrh., umphompho, *BCRH 1464*
sp., umagangeni, *BCRH 412*
Eugenia zeyheri Harv., ilijambi, isiduli sehlati†, umbelwane, *Skd*
Eulophia streptopetala Lindl., iphamba, *D&C 1836*
Euphorbia (generic), intsema, umsulusulu, *Skd*
bupleurifolia Jacq., intsele, intsema, inkamamasane, *Skd*
flanaganii N.E.Br., inkamamasane, *Skd*
gorgonis Berger, intsema, *Skd*
grandidens Haw., umlonhtlo, *Skd*; *BCRH 227*
pugniformis Boiss., intsema, inkamamasane, isihlele, *Skd*; intsema, *BCRH 380*
sp., umhlontlo, *Skd*
tetragona Haw., umhlontlo, *Skd*
tirucalli L., umhlontlo, *Skd*
triangularis Desf., umhlontlo, *D&C 1690*; *C&D*
Euryops
munitus (L.f.) B.Nord., umsola, *Skd*
sp., ulwapesi, *Skd*
spathaceus DC., iyeza lehlaba†, ulwapesi, *BCRH 1718*
Exomis microphylla (Thunb.) Aellen, umnqundu wenyathi, isibunusenyathi, umvawenyathi, *R&JG*; umvenyathi, *D&C 1515*; *Cks 7*
Fagopyrum esculentum Moench, ukutyakwentlaka, *BCRH 366*
Falkia repens L.f., umsolo, *BCRH 267*
Faurea
macnaughtonii E.Phillips, icubalatole, isafo, isifa, *Skd*
saligna Harv., isefo, isefi, isafo, *Skd*
Felicia filifolia (Vent.) Burtt Davy, igabu, igangasi, ibhosisi*, urhangasi, irangasi, *BCRH 893, 1150, 1719*
Festuca costata Nees, urwashu, *Skd*
Ficus
bizanae Hutch. & Burtt Davy, uluzi, *BCRH 492*
burtt-davyi Hutch., undendekwana, *BCRH 874, 1291*
ingens (Miq.) Miq., umkhiwane, *R&JG*
natalensis Hochst., umngqege, uluzi, umngqangqa, umzombi, umthombe, iyuzu, umgwenyezinja, *Skd*; uluzi, *BCRH 43*; *AJG 93*
sp., uvethe, *BCRH 1240*; umngxam, indendekwana, *BCRH 132, 1286*
sur Forssk., umkhiwane, uluzi, umkwane, *Skd*; ikhiwane lasendle, umkhiwane, *BCRH 1111, 1459*; uluzi, *BCRH 461, 1749*
Foeniculum vulgare Mill., imbambosi, *BCRH 830, 831, 1200*
Galenia
pubescens (Eckl. & Zeyh.) Druce., ucwethekazi, *BCRH 22*
secunda (L.f.) Sond., umfanuthinqi, *R&JG*
Galinsoga parviflora Cav., unompontshane, *Skd*; incoloshishi, ubuhlungu, ubuhlungu benyoka, untandathu, unompontshane, amampondo, uvele ludeke, icoloshishi, impontshane, imponjane, iindevu zomlungu, *BCRH 46, 47, 47a, 54, 150, 151, 339, 711, 712, 853, 1072, 1216, 1298, 1429, 1618, 1681*; *R&JG*
Garcinia gerrardii Harv. ex Sim, umbinda, umbandi, *Skd*
Gardenia thunbergia Thunb., umkangana, umkangazi, umkancaza, *Skd*; isisende, *BCRH 463*
Gasteria
bicolor Haw., intelezi, *D&C 1517, 1697*
croucheri (Hook.f.) Baker, intelezi, intelezi bululwane, *Skd*
nitida (Salm-Dyck) Haw., intelezi, *Skd*
obtusifolia (Salm-Dyck) Haw., isixhonxo, *Skd*
sp., intelezi, *BCRH 218*
Gazania
krebsiana Less., isaphepha, *R&JG*; unongwe, *C&D*
leiopoda (DC.) Rössler, isaphepha, *R&JG*
linearis (Thunb.) Druce, isapokwe, ubendle, uhlubi, umkwinti, *Skd*; umkwinde, *BCRH 1055*; isiphepha, *BCRH 115*
pectinata (Thunb.) Spreng., isaphete, umkwinti, *Skd*
Geigeria ornativa O.Hoffm., imvane, *Skd*
Geranium
canescens L'Hér., ubukhubele, utywala beentaka, *R&JG*
ornithopodon Eckl. & Zeyh. uqhobelo, *Skd*
Gerbera
ambigua (Cass.) Sch.Bip., isichwe, *BCRH 261*
piloselloides (L.) Cass., umgwashu, ubulawu, *Skd*; isichwe, umsa, *BCRH 123, 1067, 1180, 1663*; iyeza lamasi†, *C&D*
sp., isanama sesikhwenkwe, *BCRH 1488*
viridifolia (DC.) Sch.Bip., unomgushe, *D&C 1718*
Gladiolus sp., umnunge, *Skd*
Gnidia
anthylloides (L.f.) Gilg, intozwane, *Skd*
capitata L.f., isidikili, *BCRH 866*; umsila wengwe, isidikili, *BCRH 288, 1047*
cuneata Meisn., isidikili, *Skd*
sp., isidikili, iganna*, ikanna*, *Skd*; umsila wengwe, *BCRH 110, 1470*
Gomphostigma virgatum (L.f.) Baill., isepha kanonkala, umsola, *Skd*
Gomphrena globosa L., isinama *BCRH 396*
Graderia scabra (L.f.) Benth., uvelabahleke, *BCRH 1590*
Grewia
lasiocarpa E.Mey. ex Harv., umhlolo, uhlokhulu, *Skd*; uhlolo olukhulu, *BCRH 1462, 1503*
occidentalis L., umvilani, umnqabaza, *Skd*; uhlolo oluncinci, uhlolo, umnqabaza, umnqaza, unyenye, *BCRH 819, 1304, 1492, 1511, 1674*; unqabaza, *C&D*
robusta Burch., umnqabaza, *R&JG*; *C&D*
sp., uhlolo, *BCRH 35*
Greyia flanaganii Bolus, usinga lwamaxhegokazi, *Skd*
Gunnera perpensa L., iphuzi lomlambo†, *Skd*; upuzi, upuzana lomfula, ithangazana, uphuzana, indlebe yebokwe, ithanga lomlambo†, ithangazana, *BCRH 124, 376, 500, 945, 1238, 1404, 1580, 1721*; iphuzi, *D&C 1808*
Haemanthus
albiflos Jacq., umathunga, umathuma, *BCRH 71*; umathunga, *C&D*
sp., umathunga, intlolokotshane, *BCRH 1737a*; isititibala, inkuphulwana, *BCRH 495, 760*; umaweni, *C&D*
Halleria lucida L., iliminza, umbinza, *Skd*; inkobe, isibethankunzi, *BCRH 1229, 1355, 1673*
Haplocarpha
scaposa Harv., umkhanzi, isikhali, *Skd*; isicwe, *BCRH 1066*
sp., izicwe, *C&D*; uphantsikomga, *C&D*
Harpephyllum caffrum Bernh. ex Krauss, ingwenye, *R&JG*; umgwenyobomvu, isacoyi, ichanti lomlambo†, *BCRH 445, 505, 1726*; umgwenye, *BCRH 1494*; umgwenye, *C&D*
Harveya
huttonii Hiern., ibhucu, *Skd*
speciosa Bernh. ex Krauss, isinama, *Skd*
Haworthia
attenuata Haw., intelezi, *C&D*
sp., intelezi, *BCRH 226*
Helichrysum
appendiculatum (L.f.) Less., indlebevu, isitorhom*, *BCRH 989, 989a, 993*
calocephalum Klatt, umthi wechanti, *Skd*
gymnocomum DC., impepho, *BCRH 373*
miconiifolium DC., isicwe, *BCRH 1060*; umthi wetyiphu, *BCRH 403*; icholachola, *BCRH 1434*
nudifolium (L.) Less., icolocolo, *Skd*; icholachola, isicwe, *BCRH 150, 268, 1061*
odoratissimum (L.) Sweet, impepho, *BCRH 877*; *D&C 1761*; *C&D*
oxyphyllum DC., uzandokwa, *Skd*
pedunculatum Hilliard & B.L.Burtt, isicwe, isigqutsi, abakwetha, isiqutsu, *Skd*; undoqa, isigqutsi, *BCRH 79, 867, 1068, 1612*; indlebe yekati*, *BCRH 1671*
pilosellum (L.f.) Less., isichwe, *Skd*
sp., ubuhlungu bomlambo†, icholachola, *BCRH 251, 764*
splendidum (Thunb.) Less., impepho, *BCRH 1062, 1063*
trilineatum DC., impepho, *BCRH 1149*
Helinus integrifolius (Lam.) Kuntze, ubulawu obude, ithyolo, ukumbuqwekwe, *Skd*; ubulawu, uxumbukhwekhwe, isinqolamthi, ithyolo, *BCRH 21, 27, 27a, 70a, 772, 1458, s.n.*; isilawu, *D&C 1760*
Heliophila subulata Burch. ex DC., ungcilikinde, *R&JG*
Hermannia
coccocarpa (Eckl. & Zeyh.) Kuntze, umbovu, *BCRH 1687*
flammea Jacq., umsolo wetafa, *BCRH 956*
geniculata Eckl. & Zeyh., impepho yabadlezana, *Skd*; isidikili, *BCRH 170, 1155*
incana Cav., unonkotyana, umvusankunzi, *R&JG*
sp., inceba, *C&D*
Heteromorpha arborescens (Spreng.) Cham. & Schltdl.
var. *abyssinica* (A.Rich.) H.Wolff, umbangeza, umbandlala, umbangaza, imbangeza, iyeza lempambano†, *BCRH 496, 716, 1093, 1094, 1561*

Heteromorpha arborescens (cont.)
var. *arborescens*, umbangandlala, umbangandlela, *Skd*; *BCRH 203*
Heywoodia lucens Sim, umnebelele, *Skd*
Hibiscus
aethiopicus L., iyeza lamasi†, *BCRH 858*
malacospermus (Turcz.) E.Mey. ex Harv., umsangelo, *BCRH 980, 980a, 1000*
pedunculatus L.f., umthi wenduma, *BCRH 1621*
pusillus Thunb., umzongwane, *R&JG*
tiliaceus L., umlolwa, umilolo, *Skd*
trionum L., iyeza lentshulube†, *Skd*; umguzane, unomnqwazana, *BCRH 401*
Hieracium sp., unofenti, unxasana, *BCRH s.n.*, umasikeyi, *BCRH 1362*
Hippobromus pauciflorus (L.f.) Radlk., umnukambiba, ulwatile, isifutha, *Skd*; ulatile, umfazi onengxolo, ulabateka, *BCRH 96, 456, 885, 886, 1148*; *R&JG*; ilatile, *D&C 1677, 1834*
Holcus lanatus L., amazimba, *Skd*
Homalium dentatum (Harv.) Warb., igqabile, igqabela, inkomanzi, *Skd*
Huernia pendula E.A.Bruce, ubhelabhela, *Skd*
Hydrocotyle
sp., inyongwana, *Skd*
verticillata Thunb., inyongwane, *Skd*
Hyparrhenia
dregeana (Nees) Stapf, umncele, *Skd*
hirta (L.) Stapf, umngcele, *Skd*
sp., ipopo, utambuki, *Skd*; umncele, *BCRH 1084*
Hyperacanthus amoenus (Sims) Bridson, umthongothi, *Skd*; uthongothi, isende, *BCRH 398*
Hyphaene coriacea Gaertn., ilala, *Skd*
Hypochoeris
glabra L., umvawendoda, *BCRH 1331*
radicata L., umkhothane, *Skd*; umamtolo, unojenti, unomonti, uvelemonti, udatyaza, into yendodendala, *BCRH 37, 826, 1131, 1535, 1745*; *R&JG*
Hypoestes
aristata (Vahl) Soland. ex Roem. & Schult., uhlololwane, uhlololwana, uhlolwane, *BCRH 44a, 44b, 44c, 337*; R&JG
sp., uhlalane, intsasela, *BCRH 767*
Hypoxis
argentea Harv. ex Baker, ixalanxa, inongwe, *Skd*; ilabateka, *BCRH 22*; ipampa, *BCRH 1128, 1647*
hemerocallidea Fisch. & C.A.Mey., ilabatheka, ixhalanxa, *BCRH 933, 950*; ikhubalo lezithunzela, *C&D*
multiceps Buchinger ex Baker, ixhalanxa, *Skd*
rigidula Baker, ilabateka, *BCRH 1002*
sp., ixalanxa, *Skd*; *BCRH 86*; ugoboloweni, *BCRH 785*; ilabateka, *BCRH 1002a*; inongwe *C&D*
villosa L.f., inongwe, *BCRH 1637*
zeyheri Baker, inongwe, *D&C 1720*
Ilex mitis (L.) Radlk., isiduma, *Skd*; isidumo, *BCRH 798*, ubhubhubhu, ububhubhu, icimamlilo, isidumo, *BCRH 321, 400, 442, 472, 504, 645, 870*
Impatiens hochstetteri Warb., irhajojo, *R&JG*
Indigastrum fastigiatum (E.Mey.) Schrire, umhlonitshwa, *BCRH 306*
Indigofera
declinata E.Mey., iyongwe lehlathi†, *R&JG*
sp., impingele, *C&D*
stricta L.f., iyeza lomkhondo†, unomatafana, incetshe, intozane, *Skd*
Ipomoea
crassipes Hook., ubhoqo, *BCRH 158*
crispa (Thunb.) Hallier f., ubhoqo, uvuma obomvu, *R&JG*
oblongata E.Mey. ex Choisy, ubhoqo, *BCRH 1521, 586a*
oenotheroides (L.f.) Raf. ex Hallier f., isitorhom esimhlope, *BCRH 146*
purpurea (L.) Roth, imbotyi kasathana*, *Skd*; urhododo, *BCRH 447*; unobijela, *BCRH 1636*
simplex Thunb., amagantsi, amagontsi, igontsi, *BCRH 990, 1283, 1728*; amagele, *BCRH 1285*
sp., umabope, *Skd*
Isolepis cernua (Vahl) Roem. & Schult., inca yomlambo†, *BCRH 897*
Jubaeopsis caffra Becc., inkomba, *Skd*
Juncus effusus L., inxopho, *BCRH 941*
Kalanchoe
crenata (Andr.) Haw., uquwe, *BCRH 1413*
rotundifolia (Haw.) Haw., umfayisele yasehlatini†, *Skd*; ipewula, *BCRH 901*
Kedrostis
africana (L.) Cogn., uthuvana, *BCRH 106*; uthuvishe, utyuthu umadliwa, *BCRH 730*
foetidissima (Jacq.) Cogn.; utuvishe, *D&C 1681, 1710*
sp., uthuvishe, *C&D*
Kiggelaria africana L., umfayenkomo, umkhokhokho, umkhokhokho, umveti, umofunofu, umvethi, umduma, umhlinzinyati, ingcondo, umhlandela, umnovunovu, umluvuluvu, *Skd*; umathamnandi, umkhokhokho, *BCRH 241, 259*; *AJG 4893*; *R&JG*
Kniphofia
drepanophylla Baker, ixonye, *BCRH 1463*
sp. ixonyi, *Skd*; incachane, *BCRH 502*; ixonya, *C&D*
Knowltonia bracteata Harv. ex Zahlbr., umvuthuza, *Skd*
Kohautia amatymbica Eckl. & Zeyh., ikhubalo labantwana, ikhubalo elimnyama, *Skd*
Lachnostylis hirta (L.f.) Müll.Arg., ubuhlungubedile, *Skd*
Lampranthus sp., unomatyumtyuma, *BCRH 363*
Lantana
camara L., utywala bentaka, *Skd*; *BCRH 865, 1050, 1132*
rugosa Thunb., utywala bentaka, *Skd*; *BCRH 906, 907*
Laportea peduncularis (Wedd.) Chew, ububasa, ubazi, *Skd*; ubaza, *BCRH 31a, 31b*; ubazi, ububazi, iqunube, *BCRH s.n., 1356, 1665*; *R&JG*
Lasiospermum bipinnatum (Thunb.) Druce, isificane, *Skd*; isicakathi sabantwana, *BCRH 118, 935*; ubushwa, *Cks 9*
Lauridia tetragonia (L.f.) R.H.Archer, umdlavuza, *D&C 1814*
Ledebouria
cooperi (Hook.f.) Jessop, umredeni omhlophe, *BCRH 116*
floribunda (Baker) Jessop, isikholokhotho, *Skd*
revoluta (L.f.) Jessop, inqwebebane, *Skd*; inqwebeba, *C&D*; ikreketsane, *D&C 1518*; *C&D*
sp., umledina, *BCRH 1734a*; isithithibala, *Cks 22*; *C&D*
undulata (Jacq.) Jessop, umredeni omhlophe, *BCRH 116*
Leonotis
leonurus (L.) R.Br., utywala bengcungcu, imvovo, umfincafincane, *Skd*; isigagisa, umunyamunya, *BCRH 13, 1108, 1324*
ocymifolia (Burm.f.) Iwarsson, umuncwane, umfincane, umuncamunca, umfincafincane, isihlungu sedobo, *Skd*; incolotshitshi, intlolokotshane, *BCRH 117, 161, 1554*; isigagisa samahlati†, *BCRH 1107, 1746, 1154*
Lepidium
bonariense L., ukusibitsa, *BCRH 1336*
ecklonii Schrad., unocwayi, *BCRH 1374*
Lessertia perennans (Jacq.) DC., ubuhlungu bamalawu, *BCRH 926*
Leucas
capensis (Benth.) Engl., uphiphiyo, *C&D*
martinicensis (Jacq.) R.Br., umfincafincane, *Skd*; ibhoza, *BCRH 1645*; ukrakrayo, *BCRH 1344*
sp., ukhakhayo, umtekwane, ibhoza, *BCRH 1316, 1357*
Leucosidea sericea Eckl. & Zeyh., umtyityi, isidwadwa, *Skd*
Leucospermum cuneiforme (Burm.f.) Rourke, isiqwane, *Skd*
Lichtensteinia
interrupta (Thunb.) Sond., ubungashe, *Skd*; intlwathi enkulu, intlwathi, *BCRH 87, 163, 309, 1271, 1526*
kolbeana Bolus, intlwhati, *Skd*; *BCRH 121b*
sp., intlwathi, *BCRH 1417*; intlwathi enkulu, intlwathi, *BCRH 1479, 1480*; umazolwane entlwathi, *BCRH 1570*
Limeum
aethiopicum Burm., umula, *Skd*; inceba, *R&JG*
viscosum (Gay) Fenzl, unomatywabutywabu, *Skd*
Limosella grandiflora Benth., ikhubalo labadlezana, *Skd*
Lippia javanica (Burm.f.) Spreng., uvivane, isigagisa, *BCRH 6, 1582*; inzinziniba, *D&C 1505*; *C&D*
Lithospermum sp., iyeza lehlaba†, *Skd*
Lobelia (generic), itshilizi, *Skd*
caerulea Sims, ubulawu, *Skd*
erinus L., unopepirana*, ipepile* yomqala, *BCRH 301, 753, 972*
Loranthaceae, intolwane, *Skd*; isisende, *C&D*
Lycium
ferocissimum Miers, umbovu, idywadi, *Skd*
sp., umbhovu, ingcaki, *Skd*
Macaranga capensis (Baill.) Benth. ex Sim, umbengele, *Skd*
Maerua
cafra (DC.) Pax, umpunziso, *Skd*; umpunzisa, *R&JG*
racemulosa (A.DC.) Gilg & Benedict, umpunziso, umpunziso, umphunziso, umphunzisa, *Skd*
Maesa
alnifolia Harv., ucawuza, *Skd*; ucawuza, *R&JG*; ucawuzi, *BCRH 1440, 1512*
lanceolata Forssk., intendekiwane, intentekiwane, isithende, *Skd*
Malephora sp., isihlungu, *Skd*

Malva
parviflora L., unomolwana, *Skd*; umajikanelanga, *BCRH 136, 1075, 1402, 1684*; ijongilanga, *D&C 1514, 1682*; *C&D*
verticillata L., ujongilanga, ujongila, *BCRH 1073, 1074*
Margaritaria discoidea (Baill.) Webster, umphunzito, umphunzito, umphazite, *Skd*
Mariscus congestus (Vahl) C.B.Clarke, intsasela, *Skd*; incachane, incachane, imfe yesele, *BCRH 246, 280*
Marrubium vulgare L., umhlonyane wamalawu, *R&JG*; umhlonyana, *D&C 1506*; umhlonyane, *C&D*; imbuya, *Cks 13*
Massonia sp., ungcaseko, uqobeleweni, *Skd*
Matricaria nigellifolia DC., umhlonyane wamalawu, *BCRH 761*; ukudliwa ngumlambo†, umsolo, umsolo womlambo†, umhlonyane womlambo†, umhlonyane omncinane, *Skd*; umsolo, *R&JG*
Maytenus
acuminata (L.f.) Loes., umzungulwa, imnama, *Skd*; umkhaphalanga, umnana, *R&JG*
heterophylla (Eckl. & Zeyh.) N.Robson, umqaqoba, umhlangwe, *Skd*; umagcengenene, *R&JG*
nemorosa (Eckl. & Zeyh.) Marais, umhlangwe, *Skd*
peduncularis (Sond.) Loes., umnqayi, umngqi, *Skd*; umnqayinqayi, *R&JG*
Melia azedarach L., umsalinge, umserinyeni, umphafa, umsalingwe, *BCRH 257, 898, 1224, 1343, 1575*; iseringe*, *C&D*
Melianthus
comosus Vahl, ubutyayi, ubuhlungu bemamba, *Skd*; irhabiya, isidwadwa, *BCRH 60*; *R&JG*
major L., ubuhlungu bemamba, *Skd*
Melolobium candicans (E.Mey.) Eckl. & Zeyh., umakope, *Skd*
Memecylon bachmannii Engl., umbandi, *Skd*
Mentha
aquatica L., ityaleba, *Skd*; icholachola, inxima, inxina, ityeleba, *BCRH 1117*; inqina, *C&D*
longifolia (L.) L., inxina, inzinziniba, *Skd*; inxina, *BCRH 1116*
spicata L., isosi, imboza, *BCRH 1096, 1097, 1358*
Merxmuellera
cincta (Nees) Conert, urhwashu, *Skd*
disticha (Nees) Conert, usilevu, isilevu, *Skd*; urhwashu, *R&JG*
Mesembryanthemum
aitonis Jacq., iqina, *Skd*
sp., iqina, *R&JG*
Mestoklema sp., igabushe, *Skd*
Microglossa mespilifolia (Less.) B.L.Rob., ithyolo, *BCRH 804*
Mikania natalensis DC., umnxeba, *BCRH 1475*
Millettia
grandis (E.Mey.) Skeels, umtiza, umthimbiti, umsimbithi, omzambeet, umqunye, umzimbiti, umkunye, *Skd*; umsimbiti, umsimbithi, *BCRH 805, 1578*; *R&JG*
sutherlandii Harv., umkunye, *Skd*
Mimusops
caffra E.Mey. ex A.DC., umtunzi, uchole, amasetole, umhlope, umnweba, *Skd*; umntunzi, *BCRH 1415*; *R&JG*
obovata Sond., umtunzi, amasitole, umntunzi, *Skd*; umntunzi wehlathi†, *BCRH 1725*
Miscanthus
capensis (Nees) Anderss., idobo, idaba, *Skd*; umtala, isirudu, *BCRH 1085*
junceus (Stapf) Pilg., irasi, *Skd*
sp., utambuki, *Skd*; irwatshu, *BCRH 34*; *AJG 92*
Monanthotaxis caffra (Sond.) Verdc., iviriga, idwaba, idwabe, *Skd*
Mondia whitei (Hook.f.) Skeels, umindi, *Skd*
Monsonia
burkeana Planch. ex Harv., igqitha, *Skd*
emarginata (L.f.) L'Hér., igqitha, unoboyana, *Skd*
Moraea
elliotii Baker, incembu, *Skd*
polystachya (Thunb.) Ker Gawl., ukronxina, *R&JG*; urongxeni, *C&D*
Morus alba L., iqunube, *BCRH 1629*; inkatshu, *BCRH 415*
Myrsine africana L., umbovini, iyeza lenkomo†, *BCRH 1147, 1320*
Myrsiphyllum
asparagoides (L.) Willd., isicakathi, *Skd*; unomatyumtyum, ibutu, ibutho, *BCRH 250, 258, 836, 1091, 1168*
ramosissimum (Baker) Oberm., uruba, *BCRH 1287*
Nemesia melissifolia Benth., unompontshane, *BCRH 6*
Nerine filifolia Baker, itswele lenyoka, *Skd*
Nicandra physalodes (L.) Gaertn., umpungempu, ugqwangugqangu, *Skd*; amampondo, *BCRH 1651*; umpungempu, iguzu lezenga, iguzu lezinga, impungempu, iqwangu qwangu, umsobo, *BCRH 28, 28a, 28b, 28d, 29, 757, 890, 1219, 1710*
Nicotiana
glauca Graham, umgqomagqoma, ingqangangqanga, *BCRH 264, 823*; icubamfene, *D&C 1501*; *C&D*
sp., irhameti, iqhunguwa, irhamenti, icuba lesiXhosa elide, *BCRH 1753*
tabacum L., icuba elide, icuba, icuba lesibhulu, irhamente, *BCRH 813, 814, 1225, 1755*; *R&JG*
Nidorella
auriculata DC., inkanga, *BCRH 1338*
sp., ikhambi elinukayo, *BCRH 1295*; iyeza lamasi†, *D&C 1691*
Noltea africana (L.) Rchb.f., ipali ende*, iyeza lesidiya†, ipalode*, amaluleka, umglindi, umakutula, *Skd*
Nuxia
congesta R.Br. ex Fresen., umkhobeza, *Skd*
floribunda Benth., isikali, *Skd*
Nymphaea capensis Thunb., intekwane, ikhubalo lechanti, *Skd*
Obetia tenax (N.E.Br.) Friis, uluza, *Skd*
Ochna
arborea Burch. ex DC., umvithi, umthentsema, umtelele, *Skd*; umthetsema, *R&JG*
serrulata (Hochst.) Walp., ilitye, *Skd*
Ocotea bullata (Burch.) Baill., umtungwa, umhlungulu, umnukane, *Skd*; umnumbithi, *R&JG*
Oedera genistifolia (L.) Anderb. & Bremer, ibhosisi*, *BCRH 253*; *AJG 4*
Oenothera
laciniata Hill, icegceya, *BCRH 310*
rosea L'Hér.ex Aiton, isinama, isinamamnamatho, *BCRH 1597, 1606*
sp., amakholwa, *BCRH 1666*
tetraptera Cav., amakholwajika nelanga, *BCRH 1372*
Oldenburgia arbuscula DC., isiqwane, *Skd*
Olea
capensis L. subsp. *capensis*, ugqwangxe, igxwanci, umhlebe, *Skd*; umnquma isiwili, umnqumaswili, *R&JG*
capensis L. subsp. *macrocarpa* (C.H.Wright) I.Verd., umhlebe, uqwangxe, *Skd*; ugqwanxe, ugqwanxa oluncinci, *R&JG*
europaea L. subsp. *africana* (Mill.) P.S.Green, umnquma, *BCRH 891*; *R&JG*; *Skd*; *C&D*
woodiana Knobl., umgqukunqa, uqonqunga, uzintlwa, *Skd*
Olinia
radiata J. Hofmeyr & E.Phillips, umpanzi, umbomvane, inqudu, *Skd*
ventosa (L.) Cufod., umkunye, ungenalahle, inqudu, umpanzi, *Skd*; *R&JG*
Oncinotis inandensis J.M.Wood & M.S.Evans, ubuka, *Skd*
Opuntia
aurantiaca Lindl., ikati*, *BCRH 497*
sp., ugasgom, ugazina, itolofiya, *Skd*; ubhobheyani*, ikati*, *AJG 95*; *BCRH 20, 220*; ikati*, *BCRH 382*; itolofiya, *BCRH 303*; *C&D*
Ornithogalum
conicum Jacq., umredeni omhlope, *BCRH 375*
dubium Houtt., itsweletswele lasethafeni†, *Skd*
longibracteatum Jacq., ibucu, *BCRH 1738*; umredeni omhlope, *BCRH 464*
tenuifolium F.Delaroche, inqwebeba, umredeni omhlophe, *BCRH 921, 1076*
thyrsoides Jacq., umredeni omhlophe, *BCRH 922, 1103*
Osmunda regalis L., isiqhumiso, *BCRH 91*; *AJG 46*
Osteospermum
calendulaceum L.f., umayibuye, *D&C 1684*
grandidentatum DC., uqoboqoba, *Skd*
junceum P.J.Bergius, iyeza lomoya†, *BCRH 745*
sp., iyeza lomoya†, *BCRH 949*
Osyris lanceolata Hochst. & Steud., utekaza, umbulunyate, *Skd*
Oxalis
corniculata L., ummuncwane, umunchu, *BCRH 1377, 1419*
purpurata Jacq., ummuncwane, *Skd*
semiloba Sond., umuncwane, inqobo, *BCRH 1385, 1648*
smithiana Eckl. & Zeyh., izotho, umuncwane, inkolwane, *Skd*
sp., umncwane, *BCRH 755*
Oxyanthus speciosus DC. subsp. *gerrardii* (Sond.) Bridson, umbindi, *Skd*
Ozoroa
mucronata (Bernh. ex Krauss) R. & A.Fern., umphemba, *Skd*
paniculosa (Sond.) R. & A.Fern., isifuku, *Skd*
sp., umgqukunqa uzintlu, uzintlwa, *R&JG*
Pachycarpus
concolor E.Mey., igqubu lenja, itshongwe, *BCRH 184, 494*
dealbatus E.Mey., igqobole lenja, igqubu lenja, igqobulenja, *BCRH 856, 857*; *R&JG*

Pachycarpus (cont.)
sp., itshongwe, *BCRH 318*
Pachystigma venosum Hochst., umvila, uviluka, umvilo wehlati†, *Skd*
Pappea capensis Eckl. & Zeyh., ilitye, *BCRH 186*; *C&D*
Passerina sp., umnwele, *Skd*
Pavetta lanceolata Eckl., umdlesa, umponyane, umhleza, *Skd*
Peddiea africana Harv., untozwane wehlati†, intozani, isifufu, *Skd*; uluzi, *BCRH 1642*
Pelargonium
alchemilloides (L.) L'Hér., inkubele, *Skd*; umtetebu, *BCRH 1302*
caffrum (Eckl. & Zeyh.) Harv., unyawo lwenkuku, *BCRH 1282*
capitatum (L.) L'Hér., umuncwane wethafa†, *R&JG*
inquinans (L.) L'Hér., ibhosisi*, *BCRH 936*
lobatum (Burm.f.)L'Hér., indlebe yebokwe, *Skd*; *BCRH 08*
peltatum (L.) L'Hér., umnewana, ityholo, *BCRH 70, 449*
pulverulentum Colv. ex Sweet, ikubalo lomlambo, *Skd*; indlebe yebokwe, *BCRH 888*
reniforme Curtis, iyeza lesikhali†, ikubalo, *Skd*; umsongelo, *BCRH 56*; umkumiso, *D&C 1667*; *C&D*
schizopetalum Sweet, indlebe yebokwe, *BCRH s.n.*
sidoides DC., umsangela, *BCRH 1049*; umsongelo, *BCRH 1048*
sp., indlebe yebokwe, umsongelo, *Skd*; *BCRH 793*; umqwabaqwaba, *BCRH 1669*; upaqa, *BCRH 1376*
zonale (L.) L' Hér., iyeza lendlebe†, *BCRH 1205*; umsongelo, *BCRH 1620*
Pennisetum clandestinum Chiov., umadolwana, *Skd*
Pentanisia prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp., itshamlilo, irubuxa, isicimamlilo, *Skd*; icimamlilo, irhubuxa, irhumbuxa, isicimamlilo, *BCRH 144, 386, 979, 979a, 1406*
Peristrophe cernua Nees, umhlolowane, *Skd*
Persicaria lapathifolia (L.) Gray, idolo lenkonyana, *BCRH 1543*
Peucedanum
caffrum (Meisn.) E.Phillips, utambuki, *Skd*
sp., umbuhlungu, intlwati, *Skd*
Phoenix reclinata Jacq. isundu, idama*, *Skd*; isundu, *BCRH 803*
Phragmites australis (Cav.) Steud., ingcongolo, *Skd*; igagamlambo†, *BCRH 466*
Physalis
angulata L., impungempu, iyoli, itywabotywabo, *Skd*; impungempu, *BCRH 1202*
peruviana L., iguzu, *Skd*; igquzi, iguzu, iguzibele, utyuthu, *BCRH 43c, 159, 160, 1335, 1538, 1694, 1747*
sp., iguzu, ugqumgqum, *BCRH s.n., 1303*
viscosa L., usobokhulu, iquzu, *BCRH 1334*
Phytolacca
americana L., ukutya kwentaka, *BCRH 1215, 1560*; umsobosobo, *BCRH 1589*; unomadolomade, iyeza lezilonda†, *BCRH 748*
dioica L., isidungamsi, *Skd*; impangapanga, *BCRH 827*; isitinqiliti, *BCRH 92*
dodecandra L'Hér., umduduma, *R&JG*
heptandra Retz., umnyanja, *Skd*; iyeza lezilonda†, ukutya kwentaka, *BCRH 278, 1086*; ukutyakwebentaka, *BCRH 196*
octandra L., umnanja, amahashe ayatsala, *Skd*
sp., idolo lenkonyane, *BCRH 1490*
Picris echioides L., unoranga, *BCRH 919, 920*
Pittosporum viridiflorum Sims, umkhwenkwe, *Skd*; *BCRH 74, 340*
Plantago
lanceolata L., ubendlela, *R&JG*
major L., umtwane womlambo†, *Skd*; ungqengendlela, *BCRH 810*; inyama yamakhwenkwe, *BCRH 404*; unqengendlebe, *BCRH 1125*
Plectranthus
ambiguus (Bolus) Codd, irhajojo, *BCRH 736*
barbatus Andr., umgobogobo, *BCRH 408*
laxiflorus Benth., ikambi, irhajojo, *BCRH 1565, 1679*
madagascariensis (Pers.) Benth., isikholokotho, *C&D*
sp., iboza, *BCRH 726, 738*; ucakuse, *BCRH 1499*
Pleurostylia capensis (Turcz.) Loes., imbomvana, umnqanga, umngqangqa, *Skd*; umthunyelwa, *R&JG*
Plumbago auriculata Lam., umatshinintshina, umthi wamadoda†, umthi kamlanjeni, umabophe, umthi kamaqo, umthi wemibane, umabophe, *Skd*; ubuswa, ubushwa, umlanjeni, *BCRH 94, 143, 878*; utshintshini, *D&C 1676*; *C&D*; umthi kamlanjeni, *C&D*
Poaceae, utyani, ingca, *Skd*
Poaceae (Thatching grass), ingca yokufulela, *Skd*
Pollichia campestris Aiton, utywala, utywala behlungulu, *Skd*
Polygala
asbestina Burch., ungqenqendlela, *BCRH 1133*
illepida E.Mey. ex Harv., uqenqendlela, *BCRH 861*
myrtifolia L., ulopesi, *BCRH 75*; ulapesi, *BCRH 75*; umabalabala, *C&D*
serpentaria Eckl. & Zeyh., inceba, *D&C 1832*
sp., umhlonyane, uvazo, *R&JG*
Polygonum
aviculare L., iyeza lendlebe†, *BCRH 1613*
sp., iyeza lendlebe†, *BCRH s.n.*
Polystachya sp., iphamba, *D&C 1746*
Portulaca oleracea L., udywangudywangu, *Skd*; *BCRH s.n.*
Portulacaria afra Jacq., umfayisele wehlathi†, igwanitsha, igwanishe, *Skd*; *R&JG*; igwanishe, *C&D*
Potamogeton thunbergii Cham. & Schltdl., ikubalo lomkhondo wempahla, *Skd*
Premna mooiensis (H.Pearson) G.Piep., umtyetyembane, umcacabane, *Skd*
Printzia pyrifolia Less., ikofu, *BCRH 1237*
Prionium serratum (L.f.) Drège ex E.Mey., intsikani, *Skd*
Priva cordifolia (L.f.) Druce var. *abyssinica* (Jaub. & Spach) Moldenke, isinama esincinane, isinama, *BCRH 863, 864*
Protea
coronata Lam., intsasa, *Skd*
cynaroides (L.) L., isiqwane esincinci, *Skd*
lanceolata E.Mey. ex Meisn., isiqalaba, *Skd*
sp. isiqane, isiqwane, isadlungi, isiqalaba, umnqwane, indlungi, *Skd*
welwitschii Engl., isiqalaba, *Skd*
Protorhus longifolia (Bernh.) Engl., ikubalo, umkupati, umkumbati, umkomiso, isifuce, isifuco, *Skd*; izintlwa, *D&C 1751*
Prunus africana (Hook.f.) Kalkman, umkakase, *Skd*
Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt, umgilane, *BCRH 1741*
Psilocaulon parviflorum (Jacq.) Schwantes, iqina, *Skd*
Psoralea pinnata L., umhlonitshwa, *R&JG*; *D&C 1807*
Psychotria capensis (Eckl.) Vatke, umgonogono, *Skd*; izintlwa, *D&C 1817*
Psydrax obovata (Eckl. & Zeyh.) Bridson, ubombonemfene, unyelambila, *Skd*
Ptaeroxylon obliquum (Thunb.) Radlk., umthothe, umthathi, *Skd*; *BCRH 1764a*; umpafa, *BCRH 62, 440, 603, 876, 1313*; umthathi, *D&C 1503, 1820*
Pterocelastrus
rostratus Walp., itywina, *Skd*
tricuspidatus (Lam.) Sond., itywina, utwyina, ibholo, *Skd*
Pteronia incana (Burm.) DC., ibhubhusi, ibosisi*, *D&C 1500*; *C&D*
Pulicaria scabra (Thunb.) Druce, ubuhlungu bomlambo†, *BCRH 443*
Putterlickia pyracantha (L.) Szyszyl., umqaqoba, *Skd*; *C&D*
Pycnostachys reticulata (E.Mey.) Benth., itywina, *BCRH 1716*
Pycreus polystachyos (Rottb.) P.Beauv., isikhaba, *R&JG*
Pyracantha sp., undunyungu, *BCRH 1290*
Rabdosiella calycina (Benth.) Codd, umzekhwa, umpoqoza, ikhambi, *Skd*
Ranunculus
multifidus Forssk., ukukhubela, umsolo uwukhubele umlambo†, igangashane lomqalo, igangashane, irajojo, iyeza lomqala†, unotabalaza, iyeza leduma†, *BCRH 771, 854, 855, 905, 1137, 1382, 1438, 1609*; ubukhubelo, *BCRH 88*
sp., iyeza lasekaya†, *Skd*
Rapanea melanophloeos (L.) Mez, isiqalati, isiqwane sehlati†, isiqalabasehlati†, *Skd*; udumo olubomvu, umemezi, umaphipha, itshongwe lehlathi†, isiqhalapa, *BCRH 76, 254, 271, 437, 938, 1193, 1193a, 1548*; isaqoni, *BCRH 1705a*; intlungunyembe, *D&C 1813*
Raphanus raphanistrum L., isiqwashumbe, isiqwathumbe, *BCRH 32, 33, 1169, 1329, 1594*
Raphionacme
hirsuta (E.Mey.) R.A.Dyer ex E.Phillips, intsema, *Skd*; imfingwana, ingcubulenja, *BCRH 598*; ipozi, *BCRH 1703a*
sp., umfingo ubuhlungu benyoka, inogubulenja, *BCRH 967a*
Rauvolfia caffra Sond., umhlambamase, umtundisa, umjela, umhlamba amasi, *Skd*; umjelo, *R&JG*
Rawsonia lucida Harv. & Sond., umnqayi weputi, umpitshi wehlati†, umnqayi masende, umlongo, *Skd*
Relhania genistifolia (L.) L'Hér., isinuka, *Skd*
Rhamnus prinoides L'Hér., umnyenye, umlindi, *Skd*; ulatile, ulunyenye, umamfobe, unyenye, *BCRH 96, 96a, 469, 1141, 1502, 1574, 1659, 1724*; *R&JG*
Rhinephyllum sp., intshawu, *BCRH 1757a, BCRH 228*
Rhizophora mucronata Lam., umhluma, *Skd*
Rhoicissus
digitata (L.f.) Gilg & Brandt, intwanza, *Skd*; itsolo lendumbo, *BCRH 1184*; uchithibhunga, *D&C 1717, 1692*; umgcebha, *C&D*

Rhoicissus (cont.)
revoilii Planch., ingximba, *R&JG*
rhomboidea (E.Mey. ex Harv.) Planch., umnxeba, *BCRH 214*
sp., umgcebha, isaqoni, *Skd*; *BCRH 599*
tomentosa (Lam.) Wild & R.B.Drumm., isaqoni, *BCRH 1403*; uchithibhunga, *D&C 1749*
tridentata (L.f.) Wild & R.B.Drumm. subsp. *cuneifolia* (Eckl. & Zeyh.) Urton, ulatile, umnxeba, *BCRH 38, 67*
tridentata (L.f.) Wild & R.B.Drumm. subsp. *tridentata*, umnxeba, *Skd*; isaqoni, *BCRH*; *R&JG*; uchithibhunga, *D&C 1764*
Rhus (generic), intlokolotshane, *Skd*
chirindensis Baker f., intlokotshane enkulu, umhlakothi omkhulu, *Skd*; incakotshi, intlolokotshane, *BCRH 431, 1657*
crenata Thunb., umhlokotshane, *R&JG*
dentata Thunb., incakotshi, intlolokotshane yedobo, intlokotshane, *R&JG*
discolor E.Mey. ex Sond., intlokotshane, umnungumabele, inkobesehlungulu, umgumabela, *Skd*
fastigiata Eckl. & Zeyh., intlokotshane yedobo, intlokotshane encinane, *Skd*; intlokolotshane encinci, *R&JG*
incisa L.f. var. *effusa* (C.Presl) R.Fern., unongqutu, *D&C 1670*; *C&D*
laevigata L., umhlangothi, umhlakothi, *Skd*
lancea L.f., iqunguwe, iqwela, *Skd*
lucida L., intlokoshane, intlakoshanebomvu, *Skd*; umchane, amapozi, *BCRH 1578*
pyroides Burch., incakotshi, *BCRH 1296, 1697*
refracta Eckl. & Zeyh., intlolokotshane, *BCRH 710*
rehmanniana Engl., umhlakothi, umhlanghoti, intlolokotshane, intlokotshane ephakathi, *Skd*; imbokodi, *BCRH 1425, 1715*; incakotshi, *BCRH 1652*
undulata Jacq., inhlokolotshane, *Skd*
Rhynchosia
capensis (Burm.) Schinz, isachagwe, *BCRH 1649*
harveyi Eckl. & Zeyh., iyeza lesisu segazi†, *BCRH 988*; uvuma, *BCRH 216, 217, 988a, 1109*
minima (L.) DC., iyeza lesisu†, *Skd*
totta (Thunb.) DC., isicagwe, unomcela, *BCRH 1289, 1318*
Richardia brasiliensis Gomes, unomabhutyubhutyu, *BCRH 152*
Ricinus communis L., umhlavuthwa, umkakuva, umhlakuva, *Skd*; umchakuva, umhlawuvuthwa, *BCRH 91, 882, 925*
Rinorea angustifolia (Thouars) Baill., ukutya kwemfene, ugudlamfene, *Skd*
Roella glomerata A.DC., ibhosisi*, *Skd*; ugazini obomva, *BCRH 323*
Rorippa
fluviatilis (E.Mey. ex Sond.) Thell., inkatanyana, utyuthu, ubuhlungu begamba, *BCRH 307, 1345, 1474*
nasturtium-aquaticum (L.) Hayek, umkulu, *Skd*; ivatali*, uwatala*, *BCRH 1323, 1750, 1751*
Rothmannia globosa (Hochst.) Keay, umzukuza, umgupe, umsugusu, umgube, umgupa, *Skd*
Rubia petiolaris DC., ubulawu obubomvu, ubulawo, impendulo, isirwexa, *BCRH 142, 895, 1519*; impendulo, *D&C 1831*
Rubus
ludwigii Eckl. & Zeyh., iqunube, unomlatana, *BCRH 1231, 1654*
pinnatus Willd., iqunube, *Skd*; utywala bentaka, *BCRH 199, 1119, 1120, 1646*; imbimbi, *BCRH 1388*
rigidus Sm., umgcunube, *Skd*; iqunube, idinde, *BCRH 1227, 1630, 1677*
sp., ibimbi, iqunube, *Skd*; *BCRH 421, 1678*
Rumex
acetosella L., umhlonyana, *Cks 10*
crispus L., ubuhlunga, *Skd*; idolo lenkonyana, *BCRH 860, 1437*
lanceolatus Thunb., idolonyana, *Skd*; idolo lenkonyana, *BCRH 7, 156, 1532, 1693, 1727*; umncwane, *BCRH s.n., 1610*
obtusifolius L., idolo lenkonyane, *BCRH 547*
sagittatus Thunb., itonisi, *BCRH 519*
steudelii Hochst. ex A.Rich., iyeza lesilonda†, *BCRH 1134*; idolo lenkonyane, *D&C 1519*; *C&D*
Ruschia sp., igcakriya, *Skd*
Ruta graveolens L., iyeza lomoya†, ivendrit*, *BCRH 66, 763, 863, 1100, 1623*; ivendrit*, *D&C 1413*; *C&D*
Salix
babylonica L., umngcunube, umngcunube, *BCRH 1300, 1656*
capensis Thunb., umthentsema, umbhenya, umngcunube, umgcunube, umswi, *Skd*
mucronata Thunb., umnculuba, umswi, umqcwimbe, umngcunube, *Skd*; umngcumube, *BCRH s.n.*
Salsola kali L., isinama sasemasimini, *BCRH s.n.*
Salvia
aurita L.f., isicakathi, isikhikhi, *BCRH 884*
scabra L.f., isicakathi, usikhikhi, *Skd*; *BCRH 1190*
sp, umninawa, *BCRH 322*
Samolus valerandi L., umsolo womlambo†, umsolo omkulu, umtwana womlambo†, *BCRH 44, 851, 852*
Sanicula elata Buch.-Ham. ex D.Don, ubukhubelo, umvuthuza, *BCRH 242*; *AJG 932, 4894*
Sansevieria
hyacinthoides (L.) Druce, isikholokotho, *Skd*; ipewula, isikholokatha, *BCRH 98*
thyrsiflora (L.) Druce, isikolokotho, *C&D*
Sapium ellipticum (Krauss) Pax, umbongolo, umbengele, *Skd*
Sarcophyte sanguinea Sparrm., umavumbuka, *BCRH 115a, 1274*
Sarcostemma viminale (L.) R.Br., umbenele, *Skd*; iphozi, iphuzi, *BCRH 100*; umbelebele, *D&C 1666*; *C&D*
Satyrium parviflorum Sw., intelezi, *BCRH 1185*
Scabiosa
africana L., umthi wochwane, *BCRH 1123*
albanensis R.A.Dyer, isilawu, *Skd*
columbaria L., iyeza lamehlo†, *Skd*
sp., umthi omnandi, *BCRH 1668*
Scadoxus
multiflorus (Martyn) Raf. subsp. *katharinae* (Baker) Friis & Nordal, inkupulwane, *BCRH 1102*
puniceus (L.) Friis & Nordal, umphompho wezinja, *BCRH 1518*; inkuphulwana, *BCRH 111*
Scaevola plumieri (L.) Vahl, umqhaphu, *Skd*
Schefflera umbellifera (Sond.) Baill., umsenge, umkisiso, umgezisa, *Skd*
Schinus molle L., umngcunube, *BCRH 193, 908*; ipepile*, *C&D*
Schistostephium
crataegifolium (DC.) Fenzl ex Harv., umhlonyane omnyama, *BCRH 1524*
flabelliforme Less., isipetshane, *Skd*; umhlonyane omnyama, umhlonyane wamalawu, *BCRH 455*; *R&JG*
hippiifolium (DC.) Hutch., umhlonyane, *BCRH 468, 1144*
Schizoglossum cordifolium E.Mey., isiwara, *BCRH 1201*
Schkuhria pinnata (Lam.) Cabrera, umbethe wethafa†, inkatshu, *BCRH 175, 390*
Schoenoplectus
littoralis (Schrad.) Palla, umkhanzi, *BCRH 206*
paludicola (Kunth) Palla ex J.Raynal, intsasela, *Skd*
Schotia
afra (L.) Thunb., umgxam, umgonge, intiza, umqaqoba, umconci, umqonci, umquqoba, *Skd*; umgxam, umqonci, *BCRH 212, 435*
brachypetala Sond., umfofofo, ishimnumyane, *Skd*
latifolia Jacq., umgxama, umgxam, umxamo, *Skd*; umaphipha, umgxam, umthi wamakhosi†, *BCRH 104, 202, 881*; *R&JG*; umgxam, *D&C 1754, 1833*; umaphipha, *C&D*
Schrebera alata (Hochst.) Welw., umgwenyehlangula, *Skd*
Scilla
nervosa (Burch.) Jessop, umagaqana, *Skd*; inkwitelu, *BCRH*
sp., ugontsana, umasixabane, *BCRH 305, 1405*
Scirpus nodosus Rottb., idulu, *R&JG*
Scolopia
mundii (Eckl. & Zeyh.) Warb., iqumza, isinqandizembe†, umnqanqa, *Skd*; umnguni, umnqanqa, umshwaqa, iqumza, *BCRH 194*
zeyheri (Nees) Harv., umqokolo, iqumza, umqaqoba, iqumza elinameva, umquqoba, *Skd*; iqumxa elinameva, iqumza, *R&JG*
Scutia myrtina (Burm.f.) Kurz, uqapula, umqapuna, umqokwane, umsondezo, ubobo, umqaphula, *Skd*; isiphingo, umagengenene, *R&JG*; isiphingo, *C&D*
Sebaea
hymenosepala Gilg, ibulawo, *Skd*
sp., umsolo, *BCRH 58*
Secamone
alpini Schultes, iyeza lentloko†, ityholo, *BCRH 1234*; *R&JG*
filiformis (L.f.) J.H.Ross, ubuka, ikhubalo, ikhubalo elimnyama, *BCRH 204, 750, 777*; imbijela, *Cks 2*; *C&D*
Selaginella kraussiana (Kunze) A.Br. ex Kuhn, ubulawu, *BCRH*; *AJG 4883*
Selago corymbosa L., iyeza lamaqakuva†, *BCRH 937*
Senecio
albanensis DC., unodlwabiyele, *Skd*; *BCRH 333*
angulatus L.f., indindilili, *Skd*; ichongwane, ichungwane, iphungwana, *BCRH 749, 947, 1424, 1272, s.n.*; iphungwana, *BCRH 40*
brachypodus DC., iphunga, *BCRH 528*
bupleuroides DC., idwarane, *Skd*

Senecio (cont.)
coronatus (Thunb.) Harv., indlebe yebokwe, *Skd*; iyeza lesisu†, iyeza lomoya†, *BCRH 113, 423, 998, 999, 1058, 1611, s.n.*; iyeza lamasi†, *D&C 1809*
deltoideus Less., undenze, ikhubalo lesikova, *Skd*; uquntani, undenze, umdenze, iqabandlovu, *BCRH 45, 240, 1306*; *AJG 332, 832, 1311, 1664, 4892*; ithyolo, *C&D*
elegans L., izuba, *Skd*
erubescens Aiton, uvelemonti, *Skd*; *BCRH 40b, 329*
ilicifolius L., inkanga, *Skd*; *BCRH 330*
inaequidens DC., inkwandlankwandlane, inkondlonkondlwane, *BCRH 41, 42a, 42b, 1435*; impondlampondla, *BCRH 10, 42, 816, 1739*; isonki, *BCRH 1105*
isatideus DC., inkanga, *Skd*; idwara, *BCRH 1059*
latifolius DC., idwara, iyeza lasekhaya†, *Skd*
macrocephalus DC., ihlaba lenkomo, *Skd*; umthi wamahilihili, *BCRH 1604*
othonniflorus DC., idwara, *BCRH 1163*
oxyodontus DC., inkwandla, inkwandlane yaselwandle, *R&JG*
pterophorus DC., inkanga, *Skd*; *BCRH 50b*; *R&JG*
quinquelobus (Thunb.) DC., uchantikhulu, *Skd*
retrorsus DC., idwarane, idwara, *Skd*; idwara lesilonde, indwarane, *BCRH 131, 331, 842, 1069, 1070, 1071, 1160*
sp., inkamamasane, idwarane, idarane, *Skd*; utyumbembe, idwara, indendilili, iyeza lamoya†, *BCRH 282, 498, 765, 789*
speciosus Willd., umdambiso, *Skd*
Setaria verticillata (L.) P.Beauv., isinama, *Skd*
Sida dregei Burtt Davy, umdiza wethafa†, *Skd*
Sideroxylon inerme L., umqwashu, umnweba, *Skd*; umqwashu, *R&JG*; *C&D*
Silene
burchellii Otth, iyeza lehashe†, *Skd*
undulata Aiton, ubulawu obumhlope, unozitholana, iinkomo yentaba, *BCRH 284, 285, 981, 1332, 1536*; icham, ubulawu, *D&C 1502*
Sisymbrium
burchellii DC., isiqwashumbe, *Skd*
capense Thunb., isiqwashumbe, *BCRH 39*
Smodingium argutum E.Mey. ex Sond., utovani, umtomvane, *Skd*
Solanum
aculeastrum Dun., umthuma, itunga, *Skd*; umthuma, umthuma omkulu, *BCRH 114, 192, 1186, 1367, 1529, 1700*
aculeatissimum Jacq., umthuma, *BCRH 249, 1364*
burbankii Bitter, umsobo, umsobo wezinja, *BCRH 800, 801*
capense L., umthuma, *Skd*; *BCRH 1188, 1189*
chenopodioides Lam., umsobo, umsobo wezinja, *BCRH 847, 1191*
coccineum Jacq., umthuma, *BCRH 1365*
giganteum Jacq., icubalasendle, *Skd*
incanum L., umthuma, *BCRH 1199*; umthuma omncinci, *BCRH 811, 929, 930, 954, 1501*
mauritianum Scop., umbangabanga, *Skd*
nigrum L., umsobo, umsobosobo, umsobo wezinja, *Skd*; umsobo wehlathi†, umsobo wamanixwa, *BCRH 1, 1a, 1b, 3, 3b, 4, 5, 802, 1138, 1192, 1380*; umsobo, *Cks 11*; isanama, *C&D*
pseudocapsicum L., utshesi, umthuma, *Skd*; umthumawezinja, *BCRH 265*
retroflexum Dun., umsobo, umsobosobo, umvumadoda, *BCRH 2, 3a, 484, 1190, 1378, 1379, 1563, 1700, 1743*
rigescens Jacq., umthuma *Skd*; umthuma omncinci, *BCRH; AJG 89, 928*
sodomaeodes Kuntze, umtuma, *Skd*
sp., impehla, umthuma, *Skd*; umthuma, umsobo wezinja, *BCRH 900*; umathuma, *C&D*
tomentosum L., umthuma, *BCRH 69, 89, 1366*
tuberosum L., itapile*, amagqabi etapile*, iitapile*, igqabi lwetapile*, *BCRH 394, 724, 1602, 1686*
Sonchus
asper (L.) Hill, ihlaba, irwabe, irwabe lomlambo†, iyeza lethaba†, *BCRH 840, 841, 808, 904, 1593*; umarhobobo, irwabe, *BCRH 1162, 1551*
dregeanus DC., irwabe lebokwe, *Skd*; unomcwetshwana, utsolwane, irwabe lenyoka, *BCRH 419, 807, 839, 1054, 1361*; ihlabahlabane, *BCRH 986, 986a*; iyeza lehlaba†, *BCRH 407, 1432*
oleraceus L., ihlaba, irwabe, *Skd*; ihlaba, irwabe lenyoka, irwabe lethafa†, irwabe labantu, *BCRH 7, 8, 8b, 8c, 9, 806, 1057, 1326, 1327, 1398*
sp., irwabe, *BCRH 727*; imbuya ebovu, *BCRH 1360*; ihlaba, *C&D*
Sorghum
dochna (Forssk.) Snowden, imfi, imfe, *Skd*
sp., igqabi lezimba, *BCRH 361*; izimba, *BCRH 1214*
Spartium junceum L., isitorhom esimhlophe, *BCRH 1595*
Spirostachys africana Sond., umthombothi, *Skd*; *BCRH 87*; *AJG 82*
Sporobolus
africanus (Poir.) Robyns & Tournay, umtshiki, *Skd*; umsingizane, *R&JG*
pyramidalis P.Beauv., umsengilazane, umgwigwi, umsingilizane, *Skd*
Stachys
aethiopica L., isihawuhawu, *BCRH 1476*; itshilisi yabantsundu, *BCRH*; igangatshane, *BCRH 1752*
sp., unopepilana, irhajojo, *BCRH s.n.*
Stellaria media (L.) Vill., impontshane, *BCRH 1420*
Strelitzia nicolai Regel & Körn., inkamanga, isigude, isigceba, *Skd*
Streptocarpus rexii (Hook.) Lindl., umfazi, *BCRH 385*; umthi wengqele, *BCRH 370*
Striga
elegans Benth., umnake, *Skd*
gesenerioides (Willd.) Vatke ex Engl., igalo, *Skd*
Strophanthus gerrardii Stapf, amakhukhumczane, ukukhukhumeza, *Skd*
Strychnos
decussata (Pappe) Gilg, umkhangele, ilinama, umhlamalala, *Skd*; udlambalala, *C&D*
henningsii Gilg, umnonono, umnono, *Skd*; uhlambalala, umnonono, umqalothi, udlambalala, *BCRH 491, 779, 795, 927, 1140*; *R&JG*
madagascariensis Poir., umgulugula, *Skd*
mitis S.Moore, umngqunquti, *Skd*
spinosa Lam., isihlele, *Skd*; umnonono, *D&C 1752*
Sutera
aurantiaca (Burch.) Hiern, umhlonyane wetafa†, *BCRH 312, 444*
laxiflora (Benth.) Kuntze, iyeza lamehlo†, *BCRH 909*
microphylla (L.f.) Hiern, igwanishe lenyoka, *Skd*
racemosa (Benth.) Kuntze, iyeza lamehlo†, *BCRH 924*
sp., umadotyeni, umhlonyane wethafa†, *BCRH 312, 369*; itinini, *BCRH 138*
Sutherlandia frutescens (L.) R.Br., umnwele, *Skd*; ivenetyela, *BCRH 80, 471*
Syzygium
cordatum Hochst., umdoni, umswi, *Skd*; umsu, *BCRH 1099*
gerrardii (Harv. ex Hook.f.) Burtt Davy, umjomi bomva, umjome wehlati†, umanzani, *Skd*
Tabernaemontana ventricosa Hochst. ex A.DC., umhlambamasi, *Skd*
Tagetes minuta L., intsangwana, intsanguntsangu, *Skd*; unukayo, umva womfana, *BCRH 115, 391, 762, 1204*
Talinum
caffrum (Thunb.) Eckl. & Zeyh., uphuncuka, uphuncuka bemphethe, *BCRH 122, 122b, 177*; uphuluka bempethe, *BCRH 1766a*; upuncuka, *D&C 1675*
sp., umhlabelo puntsu, umhlabelo, umhlabelo ncolo, *Skd*
Taraxacum
officinale Weber (sens. lat.), irwabe lenyoka, *Skd*; uqudalele, ikhokhoyi, irwabe lethafa†, intshebe yebokhwe, unomcwetshwana, iyeza lehlaba†, umaseti, *BCRH 10, 273, 327, 739, 820, 821, 837, 1310, 1359, 1399, 1584*; ihlaba, *C&D*
serotinum (Waldst. & Kit.) Poir., irwabe lethafa†, *BCRH 11*
Tarchonanthus camphoratus L., isiduli selinde, isiduli, umathola, *Skd*; igqange, *R&JG*
Tecla natalensis (Sond.) Engl., umzane, umsingozane, *Skd*
Tecomaria capensis (Thunb.) Spach, inkaca, umsilingi, idywadi, *Skd*; icakatha, *D&C 1679*
Teedia lucida Rudolphi, uvethe, *Skd*
Tephrosia
macropoda (E.Mey.) Harv., intozane, *Skd*
polystachya E.Mey., imbanjana, imbune, *Skd*
Tetradenia riparia (Hochst.) Codd, iboza, *BCRH 104*
Tetragonia sp., utyuthu, *BCRH 302*
Teucrium
africanum Thunb., ubuhlungu benyushu, ubuhlungu, *Skd*
kraussii Codd, ubuhlungu, *Skd*
sp., ubuhlungu begusha, *BCRH 244*; *AJG 4891*
trifidum Retz., ubuhlungu belifa, ubuhlungu bebhokhwe, isihlungu sebokhwe, ubuhlungu bethafa†, *BCRH 153a, 183, 758, 946, 1174, 1439, 1699, 1730*; ubuhlungu, *D&C 1508*; *C&D*
Thalictrum rhynocarpum Dill. & Rich., unuwathala BCRH1556
Thamnocalamus
tessellatus (Nees) Soderstr. & R.P.Ellis, uduli, *Skd*; uqalo, iqalo, imbambosi*, *R&JG*
fruticosus P.J.Bergius, isinama, *Skd*
Themeda triandra Forssk., umsinde, iqunde, *Skd*; umrithi, *BCRH 838*

Thesium sp., umbiza, *C&D*
Thunbergia capensis Retz., iyeza lehashe†, *Skd*; iyeza lezilonda†, *BCRH 424*; ubuhlungu bezikhali, *Cks 14*
Thymelaceae (Family) umakhunkula, *Skd*
Tolpis capensis (L.) Sch.Bip., incolo, *BCRH 1315*
Trachyandra
affinis Kunth, isihlungu sesisu novalo†, *BCRH 1412*; uyakayakana, *R&JG*
revoluta (L.) Kunth, umpapane *R&JG*
Tragopogon porrifolius L., intshebe yebokwe, *BCRH 1368, 1698*
Trema orientalis (L.) Blume, umvumvu, uphakane, umvaganzi, umbengele, *Skd*
Tribulus terrestris L., inkunzane, *BCRH 164, 829, 1151*
Tricalysia lanceolata (Sond.) Burtt Davy, umdlesa, *Skd*
Trichilia
dregeana Sond., umkhuhlu, *Skd*; *R&JG*
emetica Vahl, umkhuhlu, *BCRH 1037*; isibara, *BCRH 459*; umkhulu, *Skd*
Trichocladus
crinitus (Thunb.) Pers., ithambo, *Skd*
ellipticus Eckl. & Zeyh., umqongci, umvawenyathi, itambo, *Skd*; isiduli, *R&JG*
Triglochin bulbosa L., inqoba yomgxobhozo, *Skd*
Trimeria grandifolia (Hochst.) Warb., utabatane, umnqabane, ixabelo, idlebendlovu, indlebe zendlovu, igqabela, igqabile, *Skd*; utshilo, intendekwana, isithebe, *BCRH 754, 1653*; *R&JG*
Tulbaghia
acutiloba Harv., isivumbampunzi, *BCRH 128*
alliacea L.f., ivimbampunzi, *Skd*; umwelela, isivumbampunzi, *BCRH 845, 1506*
sp., isivumba mpunzi, itswele lomlambo†, *Skd*; umwelela, *BCRH 834, 1483*; umwelela, *C&D*
violacea Harv., utswelane, *BCRH 1079*
Turbina sp., igqokisi, *BCRH 189, 219, 1760a*
Tylophora cordata (Thunb.) Druce, ikhubalo, *BCRH 231*; *AJG 4882*
Typha
capensis (Rohrb.) N.E.Br., inqoboka, ingcongolo, umkhanzi, *Skd*
domingensis Pers., umkhanzi, *Skd*
Umtiza listeriana Sim, umtiza, *Skd*
Urginea
altissima (L.f.) Baker, uzabokwe, *D&C 1671, 1698*; *C&D*
macrocentra Baker, injoba, *Skd*
sp., ingwebeba, *BCRH 78*; uredeni, *D&C 1704*; inqweneba, *C&D*
Urtica
dioica L., umbabazane, *Skd*; uralijane wamanxiwa, *BCRH 328*
lobulata E.Mey. ex Blume, uralijane wamanxiwa, uralijane, *Skd*; *BCRH 25a*
sp., urasi, umbabazane, amarhawu, *Skd*
urens L., uralijane wamanxiwa, umbabazane, *Skd*; uralijane, *BCRH 23a, 23b, 24, 940, 1520*
Valeriana capensis Thunb., umvuthuza, *BCRH 367*
Vangueria
infausta Burch., umvilo, *BCRH 1416*
sp., umvilo, *Skd*
Vepris lanceolata (Lam.) G.Don, umngumaswile, umzani, umnqumaswile, *Skd*; ilatile lokuqhumisa, ubulawo, ubulawo bamandungane, *BCRH 195*; *R&JG*
Verbena venosa Gillies & Hook., iyeza lokukhupha isisu†, *BCRH 311*
Vernonia
capensis (Houtt.) Druce, inkanga, *BCRH 1056*; isiqaji, *BCRH 1635*
mespilifolia Less., umsobo wehlati†, *Skd*; udomo, udunyana, uhlunguhlungu, umathamnandi, *BCRH 45, 45a 420, 740, 780, 869, 1523, 1396*; *R&JG*; uhlunguhlungu, *D&C 1759*
natalensis Sch.Bip. ex Walp., umthi wezulu, *BCRH 1088, 1181*
oligocephala (DC.) Sch.Bip. ex Walp., itshayelwana liyapungwa, *BCRH 1307*
sp., uhlunguhlungu, *Skd*
Vicia sp., ivicks*, *BCRH 275*; ivincent*, *BCRH 756*
Vigna unguiculata (L.) Walp., isacoyi, *BCRH 1481*
Vinca major L. iflawa*, *D&C 1511*; *C&D*
Viola sp., umadebeza, *BCRH 1644*
Virgilia divaricata Adamson, umzitsikama, *Skd*
Viscum
obscurum Thunb., indembu, isisende, *Skd*; isebe, *BCRH s.n.*; isisende, *C&D*
sp., umtomvi, *Skd*
Vitellariopsis marginata (N.E.Br.) Aubrév., umbumbulu, *Skd*
Vitis vinifera L., umdiliya, *BCRH 439*
Voacanga thouarsii Roem. & Schult., umtomvi, *Skd*
Wahlenbergia
rivularis Diels, ipipiyo, *Skd*
stellarioides Cham. & Schltdl., ipepilana, *Skd*
undulata (L.f.) A.DC., unopeperane, *BCRH 1130*
Walafrida
densiflora (Rolfe) Rolfe, iyeza lamaqhakuva†, *BCRH 1124, 1182*
geniculata (L.f.) Rolfe, umsolo webele, *BCRH 304*
Watsonia sp., ithembu, *BCRH 105*; igotyiba, *Skd*
Withania somnifera (L.) Dun., ubuvimba, ubushwa, ubuvumba, ucwethikazi, *BCRH 12a, 72, 939, 1552*; ubuvimba, *D&C 1516*; *C&D*
Xanthium
spinosum L., itshungu, *Skd*; ikhakakhaka, itshungu, *BCRH 414, 796, 1557*
strumarium L., itshungu, ikhakakhaka, *BCRH 413, 1239*
Xymalos monospora (Harv.) Baill. ex Warb., inkomanzi, *Skd*; umnonono, umvethi, uvethe, *BCRH*; *R&JG*
Xysmalobium
orbiculare (E.Mey.) D. Dietr., umnqathe, itshongwe, *R&JG*
undulatum (L.) W.T.Aiton, itshongwe, iyeza elimhlope†, ishongwe, *Skd*; igqubu lenja, itshongwe, itsongwe, *BCRH 991, 991a, 996, 996a, 997*
Zantedeschia
aethiopica (L.) Spreng., intebe, inyibiba, *Skd*; *BCRH 368, 1292, 1628, 1748*; umbona wemfene, *BCRH 1628*
albomaculata (Hook.) Baill. subsp. *albomaculata*, umatapile*, umbona wemfene, *BCRH 966*
sp., inyinyiba, *Skd*; umatapile*, intebe, inyibiba, *BCRH 225, 751*
Zanthoxylum
capense (Thunb.) Harv., isifutho, umnungwamabele, umlungumabele, umnikandiba, *Skd*; *BCRH 17 198, 951, 952, 1723*; *R&JG*; umlungumabele, *Cks 1*
davyi (I.Verd.) P.G.Waterman, umlungumabele, umnungumabele, *R&JG*; *Skd*; *Cks*; *C&D*
Zea mays L. umbone, *R&JG 122*
Zelmeria scabra (L.f.) Sond., itanga, usimbene, ukalimela, *Skd*; utangazana, *BCRH 1089*; ithuvana, *BCRH 982a*
Ziziphus mucronata Willd., umphafa, *R&JG*; *D&C 1711*

ECOLOGICAL TERMS

Sour grass (-veld), ijojo, *Skd*
Sweet grass (-veld), isandle, *Skd*
Forest (indigenous), ihlathi lesiXhosa, *C&D*
Forest (plantation), ihlathi lesilungu, *C&D*
Grassland, ithafa, *C&D*
Wetland, umgxobhozo, *C&D*
Desert, intlanga, *C&D*
Rocky outcrop, irexe, *C&D*
Southern aspect, umzantsi, *C&D*
Northern aspect, umntla, *C&D*

ALPHABETICAL INDEX OF XHOSA PLANT NAMES AND ECOLOGICAL TERMS

Amanzamnyama, *Anemone tenuifolia* (L.f.) DC.
Amapozi, *Rhus lucida* L.
Amarhawu, *Urtica* sp.
Amasetole, *Mimusops caffra* E.Mey. ex A.DC.
Amasitole, *Mimusops obovata* Sond.
Amasuntsu, Cucurbitaceae
Amazimba, *Holcus lanatus* L.

Exhomiseyile, *Bidens bipinnata* L.

Ibethamtunzi, *Carissa bispinosa* (L.) Desf. ex Brenan
Ibhekalanga, *Centella coriacea* Nannfd.
Ibhobhosi, *Elytropappus rhinocerotis* (L.f.) Less.
Ibholo, *Pterocelastrus tricuspidatus* (Lam.) Sond.
Ibhosisi, *Aloysia triphylla* (L'Hér.) Britton, *Calendula officinalis* L., *Chamaesyce inaequilatera* (Sond.) Soják, *Chrysocoma ciliata* L., *Felicia filifolia* (Vent.) Burtt Davy, *Oedera genistifolia* (L.) Anderb. & Bremer, *Pelargonium inquinans* (L.) L'Hér., *Roella glomerata* A.DC.
Ibhosisi yendlebe, *Abutilon sonneratianum* (Cav.) Sweet
Ibhoza, *Leucas martinicensis* (Jacq.) R.Br., *L.* sp.
Ibhubhusi, *Becium burchellianum* (Benth.) N.E.Br., *Elytropappus rhinocerotis* (L.f.) Less., *Pteronia incana* (Burm.) DC.
Ibhucu, *Agathosma apiculata* G.Mey., *Crinum* sp., *Harveya huttonii* Hiern.
Ibhudabhutha, *Datura stramonium* L.
Ibimbi, *Rubus* sp.
Ibosisi, *Pteronia incana* (Burm.) DC.
Iboza, *Plectranthus* sp., *Tetradenia riparia* (Hochst.) Codd
Ibucu, *Bulbine latifolia* (L.f.) Roem. & Schult., *Ornithogalum longibracteatum* Jacq.
Ibulawo, *Sebaea hymenosepala* Gilg
Ibutho, *Myrsiphyllum asparagoides* (L.) Willd.
Ibutu, *Myrsiphyllum asparagoides* (L.) Willd.
Icakatha, *Tecomaria capensis* (Thunb.) Spach
Icegceya, *Conyza scabrida* DC., *Oenothera laciniata* Hill
Icham, *Silene undulata* Aiton
Ichanti lomlambo, *Harpephyllum caffrum* Bernh. ex Krauss
Icholachola, *Helichrysum miconiifolium* DC., *H. nudifolium* (L.) Less., *H.* sp., *Mentha aquatica* L.
Ichongwane, *Senecio angulatus* L.f.
Ichungwane, *Senecio angulatus* L.f.
Icimamlilo, *Ilex mitis* (L.) Radlk., *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Icolocolo, *Helichrysum nudifolium* (L.) Less.
Icoloshishi, *Galinsoga parviflora* Cav.
Icuba lesiXhosa elide, *Nicotiana* sp.
Icuba lesibhulu, *Nicotiana tabacum* L.
Icuba lamatye, *Parmelia* sp.
Icuba elide, *Nicotiana tabacum* L.
Icuba, *Nicotiana tabacum* L.
Icubalasendle, *Solanum giganteum* Jacq.
Icubalatole, *Faurea macnaughtonii* E.Phillips
Icubamfene, *Nicotiana glauca* Graham
Icwanci, *Buddleja salviifolia* (L.) Lam.
Icwangi, *Buddleja salviifolia* (L.) Lam.
Idaba, *Miscanthus capensis* (Nees) Anderss.
Idabulitye, *Cissampelos capensis* L.f.
Idama, *Phoenix reclinata* Jacq.
Idarane, *Senecio* sp.
Idinde, *Rubus rigidus* Sm.
Idlebendlovu, *Trimeria grandifolia* (Hochst.) Warb.
Idobo, *Miscanthus capensis* (Nees) Anderss.
Idolo lenkonyana, *Emex australis* Steinh., *Persicaria lapathifolia* (L.) Gray, *Rumex crispus* L., *R. lanceolatus* Thunb.
Idolo lenkonyane, *Phytolacca* sp., *Rumex obtusifolius* L., *R. steudelii* Hochst. ex A.Rich.
Idolonyana, *Rumex lanceolatus* Thunb.
Idulu, *Scirpus nodosus* Rottb.
Iduma, *Erianthemum dregei* (Eckl. & Zeyh.) Tiegh.
Idumbe, *Colocasia esculenta* (L.) Schott
Idwaba, *Monanthotaxis caffra* (Sond.) Verdc.
Idwabane, *Commelina africana* L.
Idwabe, *Monanthotaxis caffra* (Sond.) Verdc.
Idwara, *Senecio isatideus* DC., *S. latifolius* DC., *S. othonniflorus* DC., *S. retrorsus* DC., *S.* sp.
Idwara lesilonde, *Senecio retrorsus* DC.
Idwarane, *Senecio bupleuroides* DC., *S. retrorsus* DC., *S.* sp.
Idywabasi, *Acacia mearnsii* De Wild.
Idywadi, *Calpurnia glabrata* Brummitt, *Lycium ferocissimum* Miers, *Tecomaria capensis* (Thunb.) Spach
Ifensi, *Cheilanthes hastata* (L.f.) Kunze, *C. quadripinnata* (Forssk.) Kuhn
Ifidi lwenkomo, *Eragrostis tef* (Zucc.) Trotter
Ifinifini, *Centaurea* sp.
Iflawa, *Vinca major* L.
Ifokwe, *Coccinia sessilifolia* (Sond.) Cogn.
Igabu, *Felicia filifolia* (Vent.) Burtt Davy
Igabushe, *Mestoklema* sp.
Igagamlambo, *Phragmites australis* (Cav.) Steud.
Igalo, *Striga gesenerioides* (Willd.) Vatke ex Engl.
Iganashane, *Berkheya decurrens* (Thunb.) Willd.
Igangashane, *Ranunculus multifidus* Forssk.
Igangashane lomqalo, *Ranunculus multifidus* Forssk.
Igangasi, *Felicia filifolia* (Vent.) Burtt Davy
Igangatshane, *Stachys aethiopica* L.
Iganna, *Gnidia* sp.
Igcakriya, *Ruschia* sp.
Igcegceleya, *Azima tetracantha* Lam., *Cassinopsis ilicifolia* (Hochst.) Kuntze
Igceya, *Azima tetracantha* Lam.
Igcokhwe, *Cussonia paniculata* Eckl. & Zeyh.
Igcukuma, *Carpobrotus edulis* (L.) L.Bolus
Igcuthuma, *Carpobrotus deliciosus* (L.Bolus) L.Bolus
Igontsi, *Asclepias gibba* (E.Mey.) Schltr., *Cyphia assimilis* Sond., *C. volubilis* (Burm.f.) Willd, *Ipomoea simplex* Thunb.
Igotyiba, *Watsonia* sp.
Igqabela, *Homalium dentatum* (Harv.) Warb., *Trimeria grandifolia* (Hochst.) Warb.
Igqabi lezimba, *Sorghum* sp.
Igqabi lwetapile, *Solanum tuberosum* L.
Igqabile, *Homalium dentatum* (Harv.) Warb., *Trimeria grandifolia* (Hochst.) Warb.
Igqange, *Buddleja saligna* Willd., *B. salviifolia* (L.) Lam., *Tarchonanthus camphoratus* L.
Igqitha, *Monsonia burkeana* Planch. ex Harv., *M. emarginata* (L.f.) L'Hér.
Igqobole lenja, *Pachycarpus dealbatus* E.Mey.
Igqokisi, *Turbina* sp.
Igqubu lenja, *Pachycarpus concolor* E.Mey., *P. dealbatus* E.Mey., *Xysmalobium undulatum* (L.) W.T.Aiton
Igquzi, *Physalis peruviana* L.
Igqwakra, *Catha edulis* (Vahl) Forssk. ex Endl., *Cunonia capensis* L.
Igqwanatya, *Commelina africana* L.
Iguzibele, *Physalis peruviana* L.
Iguzu, *Physalis peruviana* L., *P.* sp.
Iguzu lezenga, *Nicandra physalodes* (L.) Gaertn.
Iguzu lezinga, *Nicandra physalodes* (L.) Gaertn.
Igwada, *Asclepias fruticosa* L.
Igwangi, *Buddleja salviifolia* (L.) Lam.
Igwanishe lenyoka, *Sutera microphylla* (L.f.) Hiern
Igwanishe, *Portulacaria afra* Jacq.
Igwanitsha, *Portulacaria afra* Jacq.
Igwele, *Anacampseros ustulata* E.Mey ex Sond.
Igxwanci, *Olea capensis* L. subsp. *capensis*
Ihabile, *Avena sativa* L.
Ihlaba, *Sonchus asper* (L.) Hill, *S. oleraceus* L., *S.* sp., *Taraxacum officinale* Weber (sens. lat.)
Ihlaba lenkomo, *Senecio macrocephalus* DC.
Ihlabahlabane, *Sonchus dregeanus* DC.
Ihlanangobo, *Cotula heterocarpa* DC.
Ihlathi lesilungu, forest (plantation)
Ihlathi lesiXhosa, forest (indigenous)
Ihlehlwe, *Duvernoia adhatodoides* E.Mey. ex Nees.
Ihlolo getyane, *Crotalaria capensis* Jacq.
Ihobe, *Chenopodium album* L.
Iindevu zomlungu, *Galinsoga parviflora* Cav.
Iinkomo yentaba, *Silene undulata* Aiton
Iitapile, *Solanum tuberosum* L.
Ijojo, sour grass (-veld)
Ijongilanga, *Malva parviflora* L.
Ikambi, *Plectranthus laxiflorus* Benth.
Ikanna, *Gnidia* sp.
Ikati, *Opuntia aurantiaca* Lindl., *O.* sp.
Ikhakhaka, *Berkheya carduoides* (Less.) Hutch.
Ikhakakhaka, *Xanthium strumarium* L.
Ikhakhakhaka, *Berkheya carduoides* (Less.) Hutch., *B. setifera* DC., *Cirsium vulgare* (Savi) Ten., *Xanthium spinosum* L.
Ikhakhakhaka elikhulu, *Berkheya decurrens* (Thunb.) Willd.

Ikhakhakhaka lomlambo, *Berkheya carduoides* (Less.) Hutch.
Ikhala, *Aloe* (generic), *A. africana* Mill., *A. candelabrum* Berger, *A. ecklonis* Salm-Dyck, *A. ferox* Mill., *A.* sp., *Agave americana* L., *A.* sp.
Ikhalana, *Aloe* (generic), *A. tenuior* Haw.
Ikhamanga, *Agave americana* L.
Ikhambi, *Rabdosiella calycina* (Benth.) Codd
Ikhambi elinukayo, *Nidorella* sp.
Ikhambi lembelekisana, *Berkheya setifera* DC.
Ikhanakhana, *Capsicum annuum* L., *C.* sp.
Ikhiwane lasendle, *Ficus sur* Forssk.
Ikhokhoyi, *Taraxacum officinale* Weber (sens. lat.)
Ikhowa, Fungi, *Termitomyces umkowaani* (Cooke & Mass.) Reid.
Ikhubalo, *Secamone filiformis* (L.f.) J.H.Ross, *Tylophora cordata* (Thunb.) Druce
Ikhubalo elimnyama, *Kohautia amatymbica* Eckl. & Zeyh., *Secamone filiformis* (L.f.) J.H.Ross
Ikhubalo labadlezana, *Limosella grandiflora* Benth.
Ikhubalo labantwana, *Kohautia amatymbica* Eckl. & Zeyh.
Ikhubalo lechanti, *Nymphaea capensis* Thunb.
Ikhubalo lesikova, *Senecio deltoideus* Less.
Ikhubalo lezithunzela, *Hypoxis hemerocallidea* Fisch. & C.A.Mey.
Ikofu, *Printzia pyrifolia* Less.
Ikoronofile, *Allium* sp.
Ikreketsane, *Ledebouria revoluta* (L.f.) Jessop
Ikritsi, *Argemone ochroleuca* Sweet
Ikubalo, *Asparagus* sp., *Pelargonium reniforme* Curtis, *Protorhus longifolia* (Bernh.) Engl.
Ikubalo lomkhondo wempahla, *Potamogeton thunbergii* Cham. & Schltdl.
Ikubalo lomlambo, *Pelargonium pulverulentum* Colv. ex Sweet
Ikunzi emhlope, *Brunsvigia gregaria* R.A.Dyer
Ilabateka, *Hypoxis argentea* Harv. ex Baker, *H. rigidula* Baker, *H.* sp.
Ilabatheka, *Hypoxis hemerocallidea* Fisch. & C.A.Mey.
Ilala, *Hyphaene coriacea* Gaertn.
Ilamfithi, *Chrysanthemoides monilifera* (L.) Norl.
Ilatile lokuqhumisa, *Vepris lanceolata* (Lam.) G.Don
Ilijambi, *Eugenia zeyheri* Harv.
Iliminza, *Halleria lucida* L.
Ilinama, *Strychnos decussata* (Pappe) Gilg
Ilitwakela, *Drypetes arguta* (Müll.Arg.) Hutch.
Ilitye, *Ochna serrulata* (Hochst.) Walp., *Pappea capensis* Eckl. & Zeyh.
Ilotana, *Buddleja salviifolia* (L.) Lam.
Ilotyane, *Buddleja salviifolia* (L.) Lam.
Imbambosi, *Foeniculum vulgare* Mill., *Thamnocalamus tessellatus* (Nees) Soderstr. & R.P.Ellis
Imbangeza, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) H.Wolff
Imbanjana, *Tephrosia polystachya* E.Mey.
Imbijela, *Secamone filiformis* (L.f.) J.H.Ross
Imbikicane, *Bidens pilosa* L., *Chenopodium album* L., *C. mucronatum* Thunb., *C. murale* L., *C.* sp.
Imbikicane embomvu, *Chenopodium album* L.
Imbimbi, *Rubus pinnatus* Willd.
Imbokodi, *Rhus rehmanniana* Engl.
Imbomvana, *Pleurostylia capensis* (Turcz.) Loes.
Imbotyi kaxam, *Dietes iridioides* (L.) Sweet ex Klatt
Imbotyi kasathana, *Ipomoea purpurea* (L.) Roth
Imboya, *Chenopodium ambrosioides* L.
Imboza, *Mentha spicata* L.
Imbune, *Tephrosia polystachya* E.Mey.
Imbuya, *Amaranthus hybridus* L., *A. spinosus* L., *Chenopodium album* L., *Marrubium vulgare* L.
Imbuya ebovu, *Sonchus* sp.
Imfe, *Sorghum dochna* (Forssk.) Snowden
Imfe yesele, *Mariscus congestus* (Vahl) C.B.Clarke
Imfeyesele, *Carex mossii* Nelmes
Imfi, *Sorghum dochna* (Forssk.) Snowden
Imfihlo, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken, *C. tomentosa* Lam.
Imfingwana, *Raphionacme hirsuta* (E.Mey.) R.A.Dyer ex E.Phillips
Imifino, *Amaranthus hybridus* L.
Imishi, *Cyperus* sp.
Imithwane, *Cucurbita pepo* L.
Imithwane yasendle, *Cucurbita* sp.
Imizi, *Cyperus* sp., *C. textilis* Thunb.
Imnama, *Maytenus acuminata* (L.f.) Loes.
Imoleboyi, *Amaranthus thunbergii* Moq.
Impangapanga, *Phytolacca dioica* L.
Impapane, *Aloe tenuior* Haw.
Impehla, *Solanum* sp.
Impendulo, *Rubia petiolaris* DC.
Impepho, *Helichrysum gymnocomum* DC., *H. odoratissimum* (L.) Sweet, *H. splendidum* (Thunb.) Less., *H. trilineatum* DC.
Impepho yabadlezana, *Hermannia geniculata* Eckl. & Zeyh.
Impinda, *Araujia sericifera* Brot.
Impingele, *Indigofera* sp.
Impondlampondla, *Senecio inaequidens* DC.
Imponjane, *Galinsoga parviflora* Cav.
Inpontshane, *Galinsoga parviflora* Cav., *Stellaria media* (L.) Vill.
Impungempu, *Datura stramonium* L., *Nicandra physalodes* (L.) Gaertn., *Physalis angulata* L.
Imvane, *Asparagus suaveolens* Burch., *Geigeria ornativa* O.Hoffm.
Imvomvo, *Aloe* sp., *Centaurea* sp.
Imvovo, *Leonotis leonurus* (L.) R.Br.
Imvumvu, *Celtis africana* Burm.f.
Inabulele, *Convolvulus farinosus* L.
Inca yomlambo, *Isolepis cernua* (Vahl) Roem. & Schult.
Incachane, *Kniphofia* sp., *Mariscus congestus* (Vahl) C.B.Clarke
Incagolo, *Dovyalis caffra* (Hook.f. & Harv.) Hook.f.
Incakotshi, *Elephantorrhiza elephantina* (Burch.) Skeels, *Rhus chirindensis* Baker f., *R. dentata* Thunb., *R. pyroides* Burch., *R. rehmanniana* Engl.
Inceba, *Hermannia* sp., *Limeum aethiopicum* Burm., *Polygala serpentaria* Eckl. & Zeyh.
Incega, *Clutia heterophylla* Thunb.
Incema, *Cyperus marginatus* Thunb.
Incembu, *Moraea elliotii* Baker
Incetha, *Asparagus suaveolens* Burch.
Incetshe, *Indigofera stricta* L.f.
Incolo, *Tolpis capensis* (L.) Sch.Bip.
Incoloshishi, *Galinsoga parviflora* Cav.
Incolotshitshi, *Leonotis ocymifolia* (Burm.f.) Iwarsson
Incumncum, *Carissa bispinosa* (L.) Desf. ex Brenan, *C. haematocarpa* (Eckl.) A.DC.
Indara, *Cannabis sativa* L.
Indawa, *Cyperus pulcher* Thunb., *C.* sp.
Indembu, *Viscum obscurum* Thunb.
Indendekwana, *Ficus* sp.
Indindilili, *Senecio angulatus* L.f., *S.* sp.
Indiyaza, *Bersama tysoniana* Oliv.
Indlebe yebokwe, *Gunnera perpensa* L., *Marsilea macrocarpa* C.Presl, *Senecio coronatus* (Thunb.) Harv., *Pelargonium lobatum* (Burm.f.) L'Hér., *P. pulverulentum* Colv. ex Sweet, *P. schizopetalum* Sweet, *P.* sp.
Indlebe yekati, *Helichrysum pedunculatum* Hilliard & B.L.Burtt
Indlebe yenkomo, *Berkheya setifera* DC.
Indlebe zendlovu, *Trimeria grandifolia* (Hochst.) Warb.
Indlebevu, *Helichrysum appendiculatum* (L.f.) Less.
Indlela zimhlope, *Dianthus thunbergii* Hooper
Indlungi, *Protea* sp.
Indlwabiyelo, *Cotula heterocarpa* DC.
Indlwabulele, *Cotula anthemoides* L.
Indololwane, *Elephantorrhiza elephantina* (Burch.) Skeels
Indongomane, *Arachis hypogaea* L.
Indwarane, *Senecio retrorsus* DC.
Ingamdodlo, *Aloe* sp.
Ingca, *Cannabis sativa* L., *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy, Poaceae
Ingca yaselwandle, marine algae
Ingca yokufulela, Poaceae (thatching grass)
Ingcaki, *Lycium* sp.
Ingcatha, *Asparagus suaveolens* Burch.
Ingcelwane, *Aloe arborescens* Mill., *A. ecklonis* Salm-Dyck, *A. maculata* All., *Asparagus* sp., *Bulbine alooides* (L.) Willd., *B. latifolia* (L.f.) Roem. & Schult.
Ingcethe, *Conyza scabrida* DC.
Ingcili, *Clutia heterophylla* Thunb.
Ingcolo, *Dioscorea dregeana* (Kunth) T.Durand & Schinz, *D.* sp.
Ingcondo, *Kiggelaria africana* L.
Ingcongolo, *Phragmites australis* (Cav.) Steud., *Typha capensis* (Rohrb.) N.E.Br.
Ingcubulenja, *Raphionacme hirsuta* (E.Mey.) R.A.Dyer ex E.Phillips
Ingculu, *Cyperus textilis* Thunb.
Ingolwane, *Clematis brachiata* Thunb.
Ingqangangqanga, *Datura* sp., *D. stramonium* L., *Nicotiana glauca* Graham
Ingubo yesele, fresh water algae

Ingwebeba, *Urginea* sp.
Ingwenye, *Harpephyllum caffrum* Bernh. ex Krauss
Ingxalaba, *Aloe ferox* Mill.
Ingximba, *Rhoicissus revoilii* Planch.
Inhlokolotshane, *Rhus undulata* Jacq.
Injanga, *Cycnium racemosum* Benth.
Injica, *Digitaria eriantha* Steud.
Injoba, *Urginea macrocentra* Baker
Inkaca, *Tecomaria capensis* (Thunb.) Spach
Inkamamasane, *Euphorbia bupleurifolia* Jacq., *E. flanaganii* N.E.Br., *E. pugniformis* Boiss., *Senecio* sp.
Inkamanga, *Strelitzia nicolai* Regel & Körn.
Inkanga, *Amaranthus* sp., *Aster bakeranus* Burtt Davy ex C.A.Sm., *Conyza* sp., *Nidorella auriculata* DC., *Senecio ilicifolius* L., *S. isatideus* DC., *S. pterophorus* DC., *Vernonia capensis* (Houtt.) Druce
Inkatanyana, *Rorippa fluviatilis* (E.Mey. ex Sond.) Thell.
Inkatazo, *Alepidea amatymbica* Eckl. & Zeyh., *A. capensis* (P.J.Bergius) R.A.Dyer
Inkatshu, *Morus alba* L., *Schkuhria pinnata* (Lam.) Cabrera
Inkobe, *Halleria lucida* L.
Inkobesehlungulu, *Rhus discolor* E.Mey. ex Sond.
Inkolwane, *Oxalis smithiana* Eckl. & Zeyh.
Inkomanzi, *Homalium dentatum* (Harv.) Warb., *Xymalos monospora* (Harv.) Baill. ex Warb.
Inkomba, *Jubaeopsis caffra* Becc.
Inkomoyentaba, *Dianthus thunbergii* Hooper
Inkondlonkondlwane, *Senecio inaequidens* DC.
Inkowane, Fungi
Inkubele, *Pelargonium alchemilloides* (L.) L'Hér.
Inkunzane, *Emex australis* Steinh., *Tribulus terrestris* L.
Inkuphulwana, *Haemanthus* sp., *Scadoxus multiflorus* (Martyn) Raf. subsp. *katharinae* (Baker) Friis & Nordal, *S. puniceus* (L.) Friis & Nordal
Inkwandla, *Senecio oxyodontus* DC.
Inkwandlane yaselwandle, *Senecio oxyodontus* DC.
Inkwandlankwandlane, *Senecio inaequidens* DC.
Inkwitelu, *Scilla nervosa* (Burch.) Jessop
Inocelwane, *Aloe maculata* All.
Inogubulenja, *Raphionacme* sp.
Inokam, *Androcymbium longipes* Baker
Inongwane, *Centella eriantha* (Rich.) Drude
Inongwe, *Hypoxis argentea* Harv. ex Baker, *H.* sp., *H. villosa* L.f., *H. zeyheri* Baker
Inqala, *Allophyllus melanocarpus* (Sond.) Radlk.
Inqayana, *Cryptocarya wyliei* Stapf
Inqina, *Mentha aquatica* L.
Inqoba, *Cyperus esculentus* L.
Inqoba yomgxobhozo, *Triglochin bulbosa* L.
Inqobo, *Oxalis semiloba* Sond.
Inqoboka, *Cyperus fastigiatus* Rottb., *Typha capensis* (Rohrb.) N.E.Br.
Inqudu, *Olinia radiata* J.Hofmeyr & E.Phillips, *O. ventosa* (L.) Cufod.
Inqwebaba, *Albuca* sp.
Inqwebeba, *Albuca setosa* Jacq., *Ledebouria revoluta* (L.f.) Jessop, *Ornithogalum tenuifolium* F.Delaroche
Inqwebebane, *Ledebouria revoluta* (L.f.) Jessop
Inqweneba, *Urginea* sp.
Inswadi, *Boophane disticha* (L.f.) Herb.
Intebe, *Zantedeschia aethiopica* (L.) Spreng., *Z.* sp.
Intekaza, *Colpoon compressum* P.J.Bergius
Intekwane, *Nymphaea capensis* Thunb.
Intelezi, *Aloe* (generic), *A. boylei* Baker, *A. ecklonis* Salm-Dyck, *A. maculata* All., *A.* sp., *A. tenuior* Haw., *Albuca aurea* Jacq., *Aptenia cordifolia* (L.f.) Schwantes, *Bulbine asphodeloides* (L.) Willd., *Crassula* sp., *Delosperma* sp., *Dracaena aletriformis* (Haw.) Bos, *Eriospermum* sp., *Gasteria bicolor* Haw., *G. croucheri* (Hook.f.) Baker, *G. nitida* (Salm-Dyck) Haw., *G.* sp., *Haworthia attenuata* Haw., *H.* sp., *Satyrium parviflorum* Sw.
Intelezi bululwane, *Gasteria croucheri* (Hook.f.) Baker
Intelezi yobushwa, *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz
Intendekiwane, *Maesa lanceolata* Forssk.
Intendekwana, *Trimeria grandifolia* (Hochst.) Warb., *Choristylis rhamnoides* Harv.
Intentekiwane, *Maesa lanceolata* Forssk.
Intiza, *Schotia afra* (L.) Thunb.
Intlaka (gum), *Acacia karroo* Hayne
Intlakoshanebomvu, *Rhus lucida* L.
Intlakotshane enkulu, *Euclea natalensis* A.DC.
Intlanga, desert
Intlokolotshane, *Rhus* (generic)
Intlokolotshane encinci, *Rhus fastigiata* Eckl. & Zeyh.
Intlokoshane, *Rhus lucida* L.
Intlokotshane encinane, *Rhus fastigiata* Eckl. & Zeyh.
Intlokotshane enkulu, *Rhus chirindensis* Baker f.
Intlokotshane ephakathi, *Rhus rehmanniana* Engl.
Intlokotshane yedobo, *Rhus fastigiata* Eckl. & Zeyh.
Intlolokotshane, *Haemanthus* sp., *Leonotis ocymifolia* (Burm.f.) Iwarsson, *Rhus chirindensis* Baker f., *R. dentata* Thunb., *R. discolor* E.Mey. ex Sond., *R. refracta* Eckl. & Zeyh., *R. rehmanniana* Engl.
Intlolokotshane yedobo, *Rhus dentata* Thunb.
Intlungunyembe, *Acokanthera oblongifolia* (Hochst.) Codd, *A. oppositifolia* (Lam.) Codd, *Rapanea melanophloeos* (L.) Mez
Intlwathi, *Lichtensteinia interrupta* (Thunb.) Sond., *L.* sp.
Intlwathi enkulu, *Lichtensteinia interrupta* (Thunb.) Sond., *L.* sp.
Intlwati, *Peucedanum* sp.
Intlwhati, *Lichtensteinia kolbeana* Bolus
Into yendodendala, *Hypochoeris radicata* L.
Intololwanana, *Elephantorrhiza elephantina* (Burch.) Skeels
Intolwane, *Elephantorrhiza elephantina* (Burch.) Skeels, Loranthaceae
Intotyane, *Bulbine asphodeloides* (L.) Willd.
Intoyomntwana, *Cyphostemma cirrhosum* (Thunb.) Descoings ex Wild & R.B.Drumm.
Intozane, *Dais cotinifolia* L., *Englerodaphne pilosa* Burtt Davy, *Indigofera stricta* L.f., *Tephrosia macropoda* (E.Mey.) Harv.
Intozani, *Englerodaphne subcordata* (Meisn.) Engl., *Peddiea africana* Harv.
Intozwane, *Gnidia anthylloides* (L.f.) Gilg
Intsangu, *Cannabis sativa* L.
Intsanguntsangu, *Tagetes minuta* L.
Intsangwana, *Tagetes minuta* L.
Intsanzimane, *Diospyros whyteana* (Hiern) F.White
Intsasa, *Protea coronata* Lam.
Intsasela, *Hypoestes* sp., *Mariscus congestus* (Vahl) C.B.Clarke, *Schoenoplectus paludicola* (Kunth) Palla ex J.Raynal
Intsele, *Euphorbia bupleurifolia* Jacq.
Intsema, *Euphorbia* (generic), *E. bupleurifolia* Jacq., *E. gorgonis* Berger, *E. pugniformis* Boiss., *Raphionacme hirsuta* (E.Mey.) R.A.Dyer ex E.Phillips
Intsenge, *Cussonia spicata* Thunb.
Intshawu, *Rhinephyllum* sp.
Intshebe yebokhwe, *Taraxacum officinale* Weber (sens. lat.)
Intshebe yebokwe, *Tragopogon porrifolius* L.
Intshikivane, *Diospyros natalensis* (Harv.) Brenan
Intshilo, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken
Intshitshi, *Agrimonia eupatoria* L.
Intshungu, Cucurbitaceae
Intsihlo, *Capparis tomentosa* Lam., *C. sepiaria* L. var. *citrifolia* (Lam.) Toelken
Intsikani, *Prionium serratum* (L.f.) Drège ex E.Mey.
Intsinde, *Coddia rudis* (E.Mey. ex Harv.) Verdc.
Intsizi ezimayama, *Burchellia bubalina* (L.f.) Sims
Intwanza, *Rhoicissus digitata* (L.f.) Gilg & Brandt
Inxima, *Mentha aquatica* L.
Inxina, *Mentha aquatica* L., *M. longifolia* (L.) L.
Inxopho, *Juncus effusus* L.
Inyama yamakhwenkwe, *Plantago major* L.
Inyamayamakhwenkwe, *Crassula pellucida* L., subsp. *marginalis* (Dryand. in Aiton) Toelken
Inyamempunzi, *Diospyros villosa* (L.) De Winter
Inyibiba, *Zantedeschia aethiopica* (L.) Spreng., *Z.* sp.
Inyinga, *Agrimonia eupatoria* L.
Inyinyiba, *Zantedeschia* sp.
Inyongwane, *Centella coriacea* Nannfd., *C.* sp., *Hydrocotyle* sp., *H. verticillata* Thunb.
Inzica, *Digitaria eriantha* Steud.
Inzinzinaba, *Agrimonia eupatoria* L.
Inzinziniba, *Barleria* sp., *Lippia javanica* (Burm.f.) Spreng., *Mentha longifolia* (L.) L.
Ipali ende, *Noltea africana* (L.) Rchb.f.
Ipalode, *Noltea africana* (L.) Rchb.f.
Ipampa, *Hypoxis argentea* Harv. ex Baker
Ipepilana, *Wahlenbergia stellarioides* Cham. & Schltdl.
Ipepile, *Schinus molle* L.
Ipepile yomqala, *Lobelia erinus* L.
Iperepes, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Ipewula, *Kalanchoe rotundifolia* (Haw.) Haw., *Sansevieria hyacinthoides* (L.) Druce

Ipewula lethafa, *Crassula vaginata* Eckl. & Zeyh.
Iphamba, *Cyrtorchis arcuata* (Lindl.) Schltr., *Eulophia streptopetala* Lindl., *Polystachya* sp.
Iphewula, *Cotyledon orbiculata* L., *C.* sp., *Crassula* sp.
Iphozi, *Sarcostemma viminale* (L.) R.Br.
Iphunga, *Chenopodium album* L., *Senecio brachypodus* DC.
Iphungwana, *Senecio angulatus* L.f.
Iphuzi, *Centella* sp., *Gunnera perpensa* L., *Sarcostemma viminale* (L.) R.Br.
Iphuzi lomlambo, *Gunnera perpensa* L.
Ipipiyo, *Wahlenbergia rivularis* Diels
Ipopo, *Hyparrhenia* sp.
Ipozi, *Raphionacme hirsuta* (E.Mey.) R.A.Dyer ex E.Phillips
Iqabandlovu, *Senecio deltoideus* Less.
Iqalo, *Thamnocalamus tessellatus* (Nees) Soderstr. & R.P.Ellis
Iqaphula, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken
Iqhagula, *Capparis fascicularis* DC.
Iqhunguwa, *Nicotiana* sp.
Iqina, *Mesembryanthemum aitonis* Jacq., *M.* sp., *Psilocaulon parviflorum* (Jacq.) Schwantes
Iqumxa elinameva, *Scolopia zeyheri* (Nees) Harv.
Iqumza, *Scolopia zeyheri* (Nees) Harv., *S. mundii* (Eckl. & Zeyh.) Warb.
Iqumza elinameva, *Scolopia zeyheri* (Nees) Harv.
Iqunde, *Themeda triandra* Forssk.
Iqunguwe, *Rhus lancea* L.f.
Iqunube, *Laportea peduncularis* (Wedd.) Chew, *Morus alba* L., *Rubus ludwigii* Eckl. & Zeyh., *R. pinnatus* Willd., *R. rigidus* Sm., *R.* sp.
Iquzu, *Physalis viscosa* L.
Iqwangu qwangu, *Nicandra physalodes* (L.) Gaertn.
Iqwela, *Rhus lancea* L.f.
Iqwili, *Alepidea amatymbica* Eckl. & Zeyh., *A. capensis* (P.J.Bergius) R.A.Dyer
Irajojo, *Ranunculus multifidus* Forssk.
Iralibhom, *Agave americana* L.
Irangasi, *Felicia filifolia* (Vent.) Burtt Davy
Irarinathi, *Canthium mundianum* Cham. & Schltdl.
Irasi, *Miscanthus junceus* (Stapf) Pilg.
Irexe, rocky outcrop
Irhabiya, *Melianthus comosus* Vahl
Irhajojo, *Impatiens hochstetteri* Warb., *Plectranthus ambiguus* (Bolus) Codd, *P. laxiflorus* Benth., *Stachys* sp.
Irhamente, *Nicotiana tabacum* L.
Irhamenti, *Nicotiana* sp.
Irhameti, *Nicotiana* sp.
Irhubuxa, *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Irhumbuxa, *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Irododo, *Anemone tenuifolia* (L.f.) DC.
Irooiwater, *Bulbine alooides* (L.) Willd., *B. asphodeloides* (L.) Willd.
Irubuxa, *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Irwabe, *Sonchus asper* (L.) Hill, *S. oleraceus* L., *S.* sp.
Irwabe labantu, *Sonchus oleraceus* L.
Irwabe lebokwe, *Sonchus dregeanus* DC.
Irwabe lenyoka, *Sonchus dregeanus* DC., *S. oleraceus* L., *Taraxacum officinale* Weber (sens. lat.)
Irwabe lethafa, *Sonchus oleraceus* L., *Taraxacum officinale* Weber (sens. lat.), *T. serotinum* (Waldst. & Kit.) Poir.
Irwabe lomlambo, *Sonchus asper* (L.) Hill
Irwatshu, *Miscanthus* sp.
Isabetha, *Carissa bispinosa* (L.) Desf. ex Brenan
Isabetha nkunzi, *Carissa bispinosa* (L.) Desf. ex Brenan
Isacephe, *Crataegus* sp.
Isachagwe, *Rhynchosia capensis* (Burm.) Schinz
Isacoyi, *Harpephyllum caffrum* Bernh. ex Krauss, *Vigna unguiculata* (L.) Walp.
Isadlungi, *Protea* sp.
Isafo, *Faurea macnaughtonii* E.Phillips, *F. saligna* Harv.
Isagqeba, *Brachylaena elliptica* (Thunb.) DC.
Isala lentaka, *Diclis reptans* Benth.
Isanama, *Achyranthes aspera* L., *Solanum nigrum* L.
Isanama sesikhwenkwe, *Gerbera* sp.
Isanama sokugabha, *Achyranthes aspera* L.
Isandle, sweet grass (-veld)
Isangu, *Cannabis sativa* L
Isaphepha, *Gazania krebsiana* Less., *G. leiopoda* (DC.) Rössler
Isaphete, *Gazania pectinata* (Thunb.) Spreng.
Isapokwe, *Gazania linearis* (Thunb.) Druce
Isaqoni, *Rapanea melanophloeos* (L.) Mez, *Rhoicissus* sp., *R. tomentosa* (Lam.) Wild & R.B.Drumm., *R. tridentata* (L.f.) Wild & R.B.Drumm. subsp. *tridentata*
Isavu, *Conyza scabrida* DC.
Isebe, *Viscum obscurum* Thunb.
Isefi, *Faurea saligna* Harv.
Isefo, *Faurea saligna* Harv.
Iselwa lwentaka, Cucurbitaceae
Isende, *Hyperacanthus amoenus* (Sims) Bridson
Isepha kanonkala, *Gomphostigma virgatum* (L.f.) Baill.
Iseringe, *Melia azedarach* L.
Ishimnumyane, *Schotia brachypetala* Sond.
Ishongwe, *Xysmalobium undulatum* (L.) W.T.Aiton
Ishwadi, *Boophane disticha* (L.f.) Herb., *Brunsvigia gregaria* R.A.Dyer, *Dracaena hookeriana* K.Koch
Isibara, *Trichilia emetica* Vahl
Isibethankunzi, *Halleria lucida* L.
Isibhara, *Bersama tysoniana* Oliv.
Isibindi, *Ganoderma* sp.
Isibunusenyathi, *Exomis microphylla* (Thunb.) Aellen
Isicagwe, *Rhynchosia totta* (Thunb.) DC.
Isicakathi, *Agapanthus africanus* (L.) Hoffmanns., *Chlorophytum comosum* (Thunb.) Jacq., *C.* sp., *Commelina africana* L., *Myrsiphyllum asparagoides* (L.) Willd., *Salvia aurita* L.f., *S. scabra* L.f.
Isicakathi sabantwana, *Lasiospermum bipinnatum* (Thunb.) Druce
Isichwe, *Gerbera ambigua* (Cass.) Sch.Bip., *G. piloselloides* (L.) Cass., *Helichrysum pilosellum* (L.f.) Less.
Isicimamlilo, *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Isicwe, *Haplocarpha scaposa* Harv., *Helichrysum miconiifolium* DC., *H. nudifolium* (L.) Less., *H. pedunculatum* Hilliard & B.L.Burtt
Isidikili, *Gnidia capitata* L.f., *G. cuneata* Meisn., *G.* sp., *Hermannia geniculata* Eckl. & Zeyh.
Isiduli, *Brachylaena discolor* DC., *B. elliptica* (Thunb.) DC., *Chionanthus foveolatus* (E.Mey.) Stearn, *Trichocladus ellipticus* Eckl. & Zeyh., *Tarchonanthus camphoratus* L.
Isiduli sehlati, *Eugenia zeyheri* Harv.
Isiduli selinde, *Tarchonanthus camphoratus* L.
Isiduma, *Ilex mitis* (L.) Radlk.
Isidumo, *Ilex mitis* (L.) Radlk.
Isidungamsi, *Phytolacca dioica* L.
Isidwadwa, *Leucosidea sericea* Eckl. & Zeyh., *Melianthus comosus* Vahl
Isifa, *Faurea macnaughtonii* E.Phillips
Isificane, *Lasiospermum bipinnatum* (Thunb.) Druce
Isifikana, *Andropogon* sp.
Isifithi, *Baphia racemosa* (Hochst.) Baker
Isifuce, *Protorhus longifolia* (Bernh.) Engl.
Isifuco, *Protorhus longifolia* (Bernh.) Engl.
Isifufu, *Peddiea africana* Harv.
Isifuku, *Ozoroa paniculosa* (Sond.) R. & A.Fern.
Isifuta, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Isifutha, *Hippobromus pauciflorus* (L.f.) Radlk.
Isifutho, *Clausena anisata* (Willd.) Hook.f. ex Benth., *Zanthoxylum capense* (Thunb.) Harv.
Isifutu, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Isigagisa, *Acrotome inflata* Benth., *Leonotis leonurus* (L.) R.Br., *Lippia javanica* (Burm.f.) Spreng.
Isigagisa samahlati, *Leonotis ocymifolia* (Burm.f.) Iwarsson
Isigceba, *Strelitzia nicolai* Regel & Körn.
Isigqutsi, *Helichrysum pedunculatum* Hilliard & B.L.Burtt
Isigude, *Strelitzia nicolai* Regel & Körn.
Isigwamba, *Arctotis arctotoides* (L.f.) O.Hoffm.
Isihawuhawu, *Stachys aethiopica* L.
Isihihi, *Cyathea dregei* Kunze
Isihlambeza, *Agapanthus* sp.
Isihlati senja, *Eleusine coracana* (L.) Gaertn. subsp. *africana* (K.-O'Byrne) Hilu & De Wet
Isihlele, *Euphorbia pugniformis* Boiss., *Strychnos spinosa* Lam.
Isihlo esimbomvu, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken
Isihlungu, *Malephora* sp.
Isihlungu sebokhwe, *Teucrium trifidum* Retz.
Isihlungu sedobo, *Leonotis ocymifolia* (Burm.f.) Iwarsson
Isihlungu sesisu novalo, *Trachyandra affinis* Kunth
Isikali, *Nuxia floribunda* Benth.
Isikelem, *Eriospermum* sp.
Isikhaba, *Pycreus polystachyos* (Rottb.) P.Beauv.
Isikhali, *Haplocarpha scaposa* Harv.
Isikhikhi, *Salvia aurita* L.f.
Isikholokatha, *Sansevieria hyacinthoides* (L.) Druce
Isikholokhotho, *Ledebouria floribunda* (Baker) Jessop, *Plectranthus madagascariensis* (Pers.) Benth., *Sansevieria hyacinthoides* (L.) Druce

Isikhonde, *Aspidoglossum heterophyllum* E.Mey.
Isikolokotho, *Sansevieria thyrsiflora* (L.) Druce
Isikungati, *Avicennia marina* (Forssk.) Vierh., *Bruguiera gymnorrhiza* (L.) Lam.
Isilalambethe, *Commelina benghalensis* L.
Isilawu, *Behnia reticulata* (Thunb.) Didr., *Helinus integrifolius* (Lam.) Kuntze, *Scabiosa albanensis* R.A.Dyer
Isilevu, *Merxmuellera disticha* (Nees) Conert
Isinama, *Cyathula uncinulata* (Schrad.) Schinz, *Gomphrena globosa* L., *Harveya speciosa* Bernh. ex Krauss, *Oenothera rosea* L'Hér. ex Aiton, *Priva cordifolia* (L.f.) Druce var. *abyssinica* (Jaub. & Spach) Moldenke, *Setaria verticillata* (L.) P.Beauv., *Thamnocalamus fruticosus* P.J.Bergius
Isinama esikhulu, *Cyathula cylindrica* Moq., *C. uncinulata* (Schrad.) Schinz
Isinama esincici, *Cynoglossum lanceolatum* Forssk.
Isinama esincinane, *Priva cordifolia* (L.f.) Druce var. *abyssinica* (Jaub. & Spach) Moldenke
Isinama sasemasimini, *Salsola kali* L.
Isinama sebhokhwe, *Achyranthes aspera* L.
Isinamamnamatho, *Oenothera rosea* L'Hér. ex Aiton
Isindiyandiya, *Bersama lucens* (Hochst.) Szyszyl., *B. swinnyi* E.Phillips, *B. tysoniana* Oliv.
Isingiliti, *Datura* sp.
Isinonya, *Acalypha peduncularis* E.Mey. ex Meisn.
Isinqandizembe, *Scolopia mundii* (Eckl. & Zeyh.) Warb.
Isinqolamthi, *Helinus integrifolius* (Lam.) Kuntze
Isinuka, *Relhania genistifolia* (L.) L'Hér.
Isipetshane, *Schistostephium flabelliforme* Less.
Isiphambatho, *Canthium spinosum* (Klotzsch ex Eckl. & Zeyh.) Kuntze
Isiphambatho, *Anastrabe integerrima* E.Mey. ex Benth.
Isipheka, *Duvernoia adhatodoides* E.Mey. ex Nees.
Isiphepha, *Gazania linearis* (Thunb.) Druce
Isiphingo, *Canthium inerme* (L.f.) Kuntze, *Scutia myrtina* (Burm.f.) Kurz
Isiqaji, Asclepiadaceae (family), *Vernonia capensis* (Houtt.) Druce
Isiqalaba, *Protea lanceolata* E.Mey. ex Meisn., *P.* sp., *P. welwitschii* Engl.
Isiqalabasehlati, *Rapanea melanophloeos* (L.) Mez
Isiqalana, *Alberta magna* E.Mey.
Isiqalati, *Rapanea melanophloeos* (L.) Mez
Isiqane, *Protea* sp.
Isiqhalapa, *Rapanea melanophloeos* (L.) Mez
Isiqhumiso, *Clausena anisata* (Willd.) Hook.f. ex Benth., *Osmunda regalis* L.
Isiqungati, *Bruguiera gymnorrhiza* (L.) Lam.
Isiqutsu, *Helichrysum pedunculatum* Hilliard & B.L.Burtt
Isiqwane, *Leucospermum cuneiforme* (Burm.f.) Rourke, *Oldenburgia arbuscula* DC., *Protea* sp.
Isiqwane esincinci, *Protea cynaroides* (L.) L.
Isiqwane sehlati, *Rapanea melanophloeos* (L.) Mez
Isiqwashumbe, *Arctotheca calendula* (L.) Levyns, *Raphanus raphanistrum* L., *Sisymbrium burchellii* DC., *S. capense* Thunb.
Isiqwathumbe, *Raphanus raphanistrum* L.
Isirayi, *Curtisia dentata* (Burm.f.) C.A.Sm.
Isirudu, *Miscanthus capensis* (Nees) Anderss.
Isirwexa, *Rubia petiolaris* DC.
Isisefo, *Cheilanthes hastata* (L.f.) Kunze, *C. quadripinnata* (Forssk.) Kuhn
Isisende, *Gardenia thunbergia* Thunb., Loranthaceae, *Viscum obscurum* Thunb.
Isisini sekati, *Eleusine coracana* (L.) Gaertn. subsp. *africana* (K.-O'Byrne) Hilu & De Wet
Isisinisekati, *Chenopodium murale* L.
Isisinyisekathi, *Chenopodium murale* L.
Isithebe, *Trimeria grandifolia* (Hochst.) Warb.
Isithende, *Maesa lanceolata* Forssk.
Isithithibala, *Ledebouria* sp.
Isithithibala esimathunzi, *Eucomis autumnalis* (Mill.) Chitt.
Isithungu, *Cryptocarya woodii* Engl.
Isitingibawuthi, *Datura* sp.
Isitinqiliti, *Phytolacca dioica* L.
Isititibala, *Haemanthus* sp.
Isitorhom, *Cissampelos torulosa* E.Mey. ex Harv., *Helichrysum appendiculatum* (L.f.) Less.
Isitorhom esimhlope, *Ipomoea oenotheroides* (L.f.) Raf. ex Hallier f., *Spartium junceum* L.
Isitorhom sehlathi, *Cissampelos torulosa* E.Mey. ex Harv.
Isityatyisa, *Acalypha peduncularis* E.Mey. ex Meisn.
Isivumba mpunzi, *Tulbaghia* sp.
Isivumbampunzi, *Tulbaghia acutiloba* Harv., *T. alliacea* L.f.
Isivusankunzi, *Carissa bispinosa* (L.) Desf. ex Brenan, *C. haematocarpa* (Eckl.) A.DC.
Isiwara, *Schizoglossum cordifolium* E.Mey.
Isixeza, *Buxus natalensis* (Oliv.) Hutch.
Isixhonxo, *Gasteria obtusifolia* (Salm-Dyck) Haw.
Isonki, *Senecio inaequidens* DC.
Isosi, *Mentha spicata* L.
Ispilingishi, *Chenopodium* sp.
Isundu, *Cotyledon* sp., *Encephalartos altensteinii* Lehm., *Phoenix reclinata* Jacq.
Isupu, *Apium graveolens* L.
Itali, *Asparagus* sp.
Itambo, *Trichocladus ellipticus* Eckl. & Zeyh.
Itanga, *Zehneria scabra* (L.f.) Sond.
Itangazana lenja, *Cynanchum* sp.
Itapile, *Solanum tuberosum* L.
Ithafa, grassland
Ithambo, *Trichocladus crinitus* (Thunb.) Pers.
Ithanga lomlambo, *Gunnera perpensa* L.
Ithangazana, *Coccinia quinqueloba* (Thunb.) Cogn., *Cucumis africanus* L.f., *Gunnera perpensa* L.
Ithangazana lethafa, *Cucumis africanus* L.f.
Ithembu, *Dierama pendulum* (L.f.) Baker, *Watsonia* sp.
Ithobankomo, *Burchellia bubalina* (L.f.) Sims
Ithunga, *Englerophytum natalense* (Sond.) T.D.Penn.
Ithuvana, *Zehneria scabra* (L.f.) Sond.
Ithyolo, *Helinus integrifolius* (Lam.) Kuntze, *Microglossa mespilifolia* (Less.) B.L.Rob., *Senecio deltoideus* Less.
Itigiliti, *Cotula* sp.
Itile, *Buddleja auriculata* Benth.
Itimani, *Erythroxylum emarginatum* Thonn.
Itinini, *Sutera* sp.
Itlhaga, *Chloris virgata* Sw.
Itobancane, *Burchellia bubalina* (L.f.) Sims
Itolofiya, *Opuntia* sp.
Itonisi, *Rumex sagittatus* Thunb.
Itshamlilo, *Pentanisia prunelloides* (Klotzsch ex Eckl. & Zeyh.) Walp.
Itshayelwana liyapungwa, *Vernonia oligocephala* (DC.) Sch.Bip. ex Walp.
Itshilisi, *Capsicum annuum* L.
Itshilisi yabantsundu, *Stachys aethiopica* L.
Itshilizi, *Lobelia* (generic)
Itshongwe, *Pachycarpus concolor* E.Mey., *P.* sp., *Xysmalobium orbiculare* (E.Mey.) D.Dietr., *X. undulatum* (L.) W.T.Aiton
Itshongwe lehlathi, *Rapanea melanophloeos* (L.) Mez
Itshungu, *Xanthium spinosum* L., *X. strumarium* L.
Itshupu, *Baphia racemosa* (Hochst.) Baker
Itsolo lendumbo, *Rhoicissus digitata* (L.f.) Gilg & Brandt
Itsongwe, *Xysmalobium undulatum* (L.) W.T.Aiton
Itswelana, *Bulbine capitata* Poelln.
Itswele lenyoka, *Bulbine asphodeloides* (L.) Willd., *B. frutescens* (L.) Willd., *Nerine filifolia* Baker
Itswele lomlambo, *Tulbaghia* sp.
Itswelemyoka, *Bulbine asphodeloides* (L.) Willd.
Itsweletswele lasethafeni, *Ornithogalum dubium* Houtt.
Itunga, *Solanum aculeastrum* Dun.
Ityaleba, *Mentha aquatica* L.
Ityholo, *Clematis brachiata* Thunb., *Pelargonium peltatum* (L.) L'Hér., *Secamone alpini* Schultes
Ityibo, *Dombeya tiliacea* (Endl.) Planch.
Itywabotywabo, *Physalis angulata* L.
Itywina, *Pterocelastrus rostratus* Walp., *P. tricuspidatus* (Lam.) Sond., *Pycnostachys reticulata* (E.Mey.) Benth.
Ivane, *Asparagus africanus* Lam., *A. racemosus* Willd.
Ivatali, *Rorippa nasturtium-aquaticum* (L.) Hayek
Ivendrit, *Ruta graveolens* L.
Ivenetyela, *Sutherlandia frutescens* (L.) R.Br.
Ivetirati, *Boscia oleoides* (Burch. ex DC.) Toelken
Ivicks, *Vicia* sp.
Ivimbampunzi, *Allium sativum* L., *Tulbaghia alliacea* L.f.
Ivincent, *Vicia* sp.
Iviriga, *Monanthotaxis caffra* (Sond.) Verdc.
Ivumbangwe, *Datura stramonium* L.
Iwatile, *Acacia cyclops* A.Cunn. ex G.Don
Iwatlisi, *Acacia mearnsii* De Wild.
Iwintili, *Acacia cyclops* A.Cunn. ex G.Don
Ixabelo, *Trimeria grandifolia* (Hochst.) Warb.

Ixalanxa, *Hypoxis argentea* Harv. ex Baker, *H.* sp.
Ixhalanxa, *Hypoxis hemerocallidea* Fisch. & C.A.Mey., *H. multiceps* Buchinger ex Baker
Ixolo lamatye, *Barbula crinita* Schultz
Ixonya, *Cyperus* sp., *Kniphofia* sp.
Ixonye, *Kniphofia drepanophylla* Baker
Ixonyi, *Kniphofia* sp.
Iyeza elimhlope, *Xysmalobium undulatum* (L.) W.T.Aiton
Iyeza elimnyama, *Anemone caffra* Eckl. & Zeyh.
Iyeza lamadoda, *Conyza* sp.
Iyeza lamaqakuva, *Selago corymbosa* L.
Iyeza lamaqhakuva, *Walafrida densiflora* (Rolfe) Rolfe
Iyeza lamasi, *Gerbera piloselloides* (L.) Cass., *Hibiscus aethiopicus* L., *Nidorella* sp., *Senecio coronatus* (Thunb.) Harv.
Iyeza lamehlo, *Scabiosa columbaria* L., *Sutera laxiflora* (Benth.) Kuntze, *S. racemosa* (Benth.) Kuntze
Iyeza lamoya, *Senecio* sp.
Iyeza lasekaya, *Ranunculus* sp.
Iyeza lasekhaya, *Senecio latifolius* DC.
Iyeza ledliso, *Cheilanthes viridis* (Forssk.) Sw.
Iyeza leduma, *Ranunculus multifidus* Forssk.
Iyeza lehashe, *Bulbine asphodeloides* (L.) Willd., *Silene burchellii* Otth, *Thunbergia capensis* Retz.
Iyeza lehlaba, *Euryops spathaceus* DC., *Lithospermum* sp., *Sonchus dregeanus* DC., *Taraxacum officinale* Weber (sens. lat.)
Iyeza lemimoya emibi, *Eriosema parviflorum* E.Mey.
Iyeza lempambano, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) H.Wolff
Iyeza lencukuthu, *Chenopodium ambrosioides* L.
Iyeza lendlebe, *Pelargonium zonale* (L.) L' Hér., *Polygonum aviculare* L., *P.* sp.
Iyeza lenkomo, *Myrsine africana* L.
Iyeza lentloko, *Secamone alpini* Schultes
Iyeza lentshulube, *Acalypha peduncularis* E.Mey. ex Meisn., *Aster bakeranus* Burtt Davy ex C.A.Sm., *Hibiscus trionum* L.
Iyeza lesidiya, *Noltea africana* (L.) Rchb.f.
Iyeza lesikhali, *Pelargonium reniforme* Curtis
Iyeza lesilonda, *Rumex steudelii* Hochst. ex A.Rich.
Iyeza lesisu, *Cephalaria oblongifolia* (Kuntze) Szabó, *Cyanotis speciosa* (L.f.) Hassk., *Rhynchosia minima* (L.) DC., *Senecio coronatus* (Thunb.) Harv.
Iyeza lesisu segazi, *Rhynchosia harveyi* Eckl. & Zeyh.
Iyeza lesisu xa umfazi ekhulelwe, *Berkheya setifera* DC.
Iyeza lethaba, *Sonchus asper* (L.) Hill
Iyeza lezilonda, *Phytolacca americana* L., *P. heptandra* Retz., *Thunbergia capensis* Retz.
Iyeza lipulayiti, *Bulbine abyssinica* A.Rich.
Iyeza logezo, *Athrixia heterophylla* (Thunb.) Less.
Iyeza lokugabha, *Cassine aethiopica* Thunb.
Iyeza lokukhupha isisu, *Verbena venosa* Gillies & Hook.
Iyeza lokuxaxuzisa, *Euclea crispa* (Thunb.) Guerke
Iyeza lomgqwaliso, *Agrimonia procera* Wallr.
Iyeza lomkhondo, *Crabbea nana* Nees, *Indigofera stricta* L.f.
Iyeza lomoya, *Chenopodium ambrosioides* L., *Conyza scabrida* DC., *C.* sp., *Osteospermum junceum* P.J.Bergius, *O.* sp., *Ruta graveolens* L., *Senecio coronatus* (Thunb.) Harv.
Iyeza lomqala, *Ranunculus multifidus* Forssk.
Iyoli, *Physalis angulata* L.
Iyongwe lehlathi, *Indigofera declinata* E.Mey.
Iyuzu, *Ficus natalensis* Hochst.
Izambhalo zokugqubhuza, *Cyanella lutea* L.f.
Izicwe, *Haplocarpha* sp.
Izihlwele, *Behnia reticulata* (Thunb.) Didr.
Izimba, *Sorghum* sp.
Izintlwa, *Protorhus longifolia* (Bernh.) Engl., *Psychotria capensis* (Eckl.) Vatke
Izotho, *Oxalis smithiana* Eckl. & Zeyh.
Izuba, *Senecio elegans* L.

Lihobe, *Chenopodium murale* L.

Omzambeet, *Millettia grandis* (E.Mey.) Skeels

Ubaza, *Laportea peduncularis* (Wedd.) Chew
Ubazi, *Laportea peduncularis* (Wedd.) Chew
Ubece, Cucurbitaceae
Ubende, *Pteridium aquilinum* (L.) Kuhn
Ubendle, *Gazania linearis* (Thunb.) Druce
Ubendlela, *Plantago lanceolata* L.
Ubhelabhela, *Huernia pendula* E.A.Bruce
Ubhobheyani, *Opuntia* sp.
Ubhoqo, *Convolvulus* sp., *Ipomoea crassipes* Hook., *I. crispa* (Thunb.) Hallier f., *I. oblongata* E.Mey. ex Choisy
Ubhoqom, *Convolvulus* sp.
Ubhubhubhu, *Ilex mitis* (L.) Radlk.
Ubobo, *Caesalpinia decapetala* (Roth) Alston, *C. pulcherrima* (L.) Schwartz, *Dalbergia armata* E.Mey., *Scutia myrtina* (Burm.f.) Kurz
Ubokwe, *Convolvulus sagitattus* Thunb.
Ubomboneinfene, *Psydrax obovata* (Eckl. & Zeyh.) Bridson
Uboqo, *Convolvulus farinosus* L., *C. natalensis* Bernh. apud Krauss
Uboqo wabadlezana, *Convolvulus farinosus* L.
Uboqo wabadlezana, *Convolvulus sagitattus* Thunb.
Uboya bemithi, *Usnea* sp.
Ububasa, *Laportea peduncularis* (Wedd.) Chew
Ububazi, *Laportea peduncularis* (Wedd.) Chew
Ubuchopho, *Canthium ciliatum* (Klotzch) Kuntze, *C. kuntzeanum* Bridson
Ubuhlunga, *Rumex crispus* L.
Ubuhlungu, *Acokanthera oblongifolia* (Hochst.) Codd, *A. oppositifolia* (Lam.) Codd, *Galinsoga parviflora* Cav., *Teucrium africanum* Thunb., *T. kraussii* Codd, *T. trifidum* Retz.
Ubuhlungu bamalawu, *Lessertia perennans* (Jacq.) DC.
Ubuhlungu bebhokhwe, *Teucrium trifidum* Retz.
Ubuhlungu bechanti, *Eucomis autumnalis* (Mill.) Chitt.
Ubuhlungu bedila, *Clutia heterophylla* Thunb.
Ubuhlungu begamba, *Rorippa fluviatilis* (E.Mey. ex Sond.) Thell.
Ubuhlungu begusha, *Teucrium* sp.
Ubuhlungu belifa, *Teucrium trifidum* Retz.
Ubuhlungu benamba, *Acokanthera oppositifolia* (Lam.) Codd, *Melianthus major* L., *M. comosus* Vahl
Ubuhlungu benyoka, *Acokanthera oblongifolia* (Hochst.) Codd, *A. oppositifolia* (Lam.) Codd, *Burchellia bubalina* (L.f.) Sims, *Galinsoga parviflora* Cav.
Ubuhlungu benyushu, *Teucrium africanum* Thunb.
Ubuhlungu beramba, *Conyza obscura* DC., *C. pinnata* (L.f.) Kuntze
Ubuhlungu besigcawu, *Blepharis capensis* (L.f.) Pers., *Crabbea nana* Nees
Ubuhlungu bethafa, *Teucrium trifidum* Retz.
Ubuhlungu bezikhali, *Thunbergia capensis* Retz.
Ubuhlungu bomlambo, *Blumea alata* (D.Don) DC., *Chlorophytum comosum* (Thunb.) Jacq., *Helichrysum* sp., *Pulicaria scabra* (Thunb.) Druce
Ubuhlungu bomThwa, *Acokanthera oppositifolia* (Lam.) Codd
Ubuhlungubedile, *Lachnostylis hirta* (L.f.) Müll.Arg.
Ubuka, *Oncinotis inandensis* J.M.Wood & M.S.Evans, *Secamone filiformis* (L.f.) J.H.Ross
Ubukhubele, *Geranium canescens* L'Hér.
Ubukhubelo, *Ranunculus multifidus* Forssk., *Sanicula elata* Buch.-Ham. ex D.Don
Ubulawo, *Rubia petiolaris* DC., *Vepris lanceolata* (Lam.) G.Don
Ubulawo bamandungane, *Vepris lanceolata* (Lam.) G.Don
Ubulawu, *Alepidea serrata* Eckl. & Zeyh., *Asparagus falcatus* L., Asteraceae (as a family), *Dianthus thunbergii* Hooper, *Gerbera piloselloides* (L.) Cass., *Helinus integrifolius* (Lam.) Kuntze, *Lobelia caerulea* Sims, *Selaginella kraussiana* (Kunze) A.Br. ex Kuhn, *Silene undulata* Aiton
Ubulawu bamagqira, *Pteridium aquilinum* (L.) Kuhn
Ubulawu obubomvu, *Rubia petiolaris* DC.
Ubulawu obude, *Helinus integrifolius* (Lam.) Kuntze
Ubulawu obumhlope, *Asparagus africanus* Lam., *Dianthus thunbergii* Hooper, *Silene undulata* Aiton
Ubulembu, Bryophyta
Ubulembu belitye, *Parmelia* sp.
Ubungashe, *Lichtensteinia interrupta* (Thunb.) Sond.
Ubungxani, Asclepiadaceae (family)
Ubushwa, *Aizoon glinoides* L.f., *Arctotis arctotoides* (L.f.) O.Hoffm., *Lasiospermum bipinnatum* (Thunb.) Druce, *Plumbago auriculata* Lam., *Withania somnifera* (L.) Dun.
Ubushwa bamehlo, *Clutia pulchella* L.
Ubutyayi, *Melianthus comosus* Vahl
Ubuvimba, *Withania somnifera* (L.) Dun.
Ubuvumba, *Withania somnifera* (L.) Dun.
Ucakuse, *Plectranthus* sp.
Ucaphazana, *Berula erecta* (Hudson) Coville subsp. *thunbergii* (DC.) B.L.Burtt
Ucawuza, *Maesa alnifolia* Harv.
Ucawuzi, *Maesa alnifolia* Harv.
Uchantikhulu, *Senecio quinquelobus* (Thunb.) DC.

Uchithibhunga, *Rhoicissus digitata* (L.f.) Gilg & Brandt, *R. tomentosa* (Lam.) Wild & R.B.Drumm., *R. tridentata* (L.f.) Wild & R.B.Drumm. subsp. *tridentata*
Uchole, *Mimusops caffra* E.Mey. ex A.DC.
Ucwethekazi, *Aizoon glinoides* L.f., *Galenia pubescens* (Eckl. & Zeyh.) Druce.
Ucwethikazi, *Withania somnifera* (L.) Dun.
Udatyaza, *Hypochoeris radicata* L.
Udlambalala, *Strychnos decussata* (Pappe) Gilg, *S. henningsii* Gilg
Udomo, *Vernonia mespilifolia* Less.
Uduli, *Thamnocalamus tessellatus* (Nees) Soderstr. & R.P.Ellis
Udumo olubomvu, *Rapanea melanophloeos* (L.) Mez
Udunyana, *Vernonia mespilifolia* Less.
Udywangudywangu, *Portulaca oleracea* L.
Ufokwe, *Coccinia quinqueloba* (Thunb.) Cogn.
Ugasgom, *Opuntia* sp.
Ugazina, *Opuntia* sp.
Ugazini obomva, *Roella glomerata* A.DC.
Ugcadolo, *Bidens bipinnata* L., *B. pilosa* L.
Ugobeleweni, *Clivia* sp.
Ugoboloweni, *Hypoxis* sp.
Ugontsana, *Scilla* sp.
Ugqumgqum, *Physalis* sp.
Ugqwangugqangu, *Nicandra physalodes* (L.) Gaertn.
Ugqwangxe, *Olea capensis* L. subsp. *capensis*
Ugqwanxa oluncinci, *Olea capensis* L. subsp. *macrocarpa* (C.H.Wright) I.Verd.
Ugqwanxe, *Olea capensis* L. subsp. *macrocarpa* (C.H.Wright) I.Verd.
Ugudlamfene, *Rinorea angustifolia* (Thouars) Baill.
Uguwe, *Crassula spathulata* Thunb.
Uhlalane, *Hypoestes* sp.
Uhlambalala, *Strychnos henningsii* Gilg
Uhlokhulu, *Grewia lasiocarpa* E.Mey. ex Harv.
Uhlolo, *Grewia occidentalis* L., *G.* sp.
Uhlolo olukhulu, *Grewia lasiocarpa* E.Mey. ex Harv.
Uhlolo oluncinci, *Grewia occidentalis* L.
Uhlololwana, *Hypoestes aristata* (Vahl) Soland. ex Roem. & Schult.
Uhlolwane, *Hypoestes aristata* (Vahl) Soland. ex Roem. & Schult.
Uhlotshane, *Commelina benghalensis* L.
Uhlubi, *Gazania linearis* (Thunb.) Druce
Uhlunguhlungu, *Vernonia mespilifolia* Less., *V.* sp.
Ujejane, *Chlorophytum comosum* (Thunb.) Jacq.
Ujikenxaniwe, *Amaranthus hybridus* L., *A.* sp., *A. thunbergii* Moq.
Ujiyane, *Chlorophytum comosum* (Thunb.) Jacq.
Ujodo, Cucurbitaceae
Ujongila, *Malva verticillata* L.
Ujongilanga, *Malva verticillata* L.
Ukakayi, *Acrotome inflata* Benth.
Ukakhayi, *Asclepias fruticosa* L.
Ukalimela, *Zehneria scabra* (L.f.) Sond.
Ukhakhayo, *Leucas* sp.
Ukhovothi, *Cassinopsis ilicifolia* (Hochst.) Kuntze
Ukrakrayo, *Leucas martinicensis* (Jacq.) R.Br.
Ukronxina, *Moraea polystachya* (Thunb.) Ker Gawl.
Ukudliwa ngumlambo, *Matricaria nigellifolia* DC.
Ukukhubela, *Ranunculus multifidus* Forssk.
Ukukhukhumeza, *Strophanthus gerrardii* Stapf
Ukumbuqwekwe, *Helinus integrifolius* (Lam.) Kuntze
Ukusibitsa, *Lepidium bonariense* L.
Ukutya kwentaka, *Phytolacca americana* L., *P. heptandra* Retz.
Ukutya kwemfene, *Rinorea angustifolia* (Thouars) Baill.
Ukutyakwebentaka, *Phytolacca heptandra* Retz.
Ukutyakwentlaka, *Fagopyrum esculentum* Moench
Ukuxeka, *Buxus natalensis* (Oliv.) Hutch.
Ulabateka, *Hippobromus pauciflorus* (L.f.) Radlk.
Uladolo, *Bidens pilosa* L.
Ulandile, *Combretum kraussii* Hochst.
Ulapesi, *Polygala myrtifolia* L.
Ulatile, *Hippobromus pauciflorus* (L.f.) Radlk., *Rhamnus prinoides* L'Hér., *Rhoicissus tridentata* (L.f.) Wild & R.B.Drumm. subsp. *cuneifolia* (Eckl. & Zeyh.) Urton
Ulonwabo, *Commiphora woodii* Engl.
Ulopesi, *Polygala myrtifolia* L.
Uluhlaza, *Cassinopsis tinifolia* Harv.
Ulunyenye, *Rhamnus prinoides* L'Hér.
Uluvethe, *Clerodendrum glabrum* E.Mey.
Uluza, *Cynanchum obtusifolium* L.f., *Ficus bizanae* Hutch. & Burtt Davy, *F. natalensis* Hochst., *F. sur* Forssk., *Obetia tenax* (N.E.Br.) Friis, *Peddiea africana* Harv.
Ulwamfithi, *Chrysanthemoides monilifera* (L.) Norl.
Ulwapesi, *Euryops* sp., *E. spathaceus* DC.
Ulwatile, *Hippobromus pauciflorus* (L.f.) Radlk.
Umabalabala, *Polygala myrtifolia* L.
Umabophe, *Acridocarpus natalitius* Juss., *Boscia oleoides* (Burch. ex DC.) Toelken, *Ipomoea* sp., *Plumbago auriculata* Lam.
Umadebeza, *Viola* sp.
Umadliwa kuhlinzwa, Cucurbitaceae
Umadolwana, *Chloris virgata* Sw., *Commelina erecta* L., *Cyanotis speciosa* (L.f.) Hassk., *Digitaria sanguinalis* (L.) Scop., *Pennisetum clandestinum* Chiov.
Umadotyeni, *Sutera* sp.
Umagangeni, *Eucomis* sp.
Umagaqana, *Bowiea volubilis* Harv. ex Hook.f., *Scilla nervosa* (Burch.) Jessop
Umagcengenene, *Maytenus heterophylla* (Eckl. & Zeyh.) N.Robson
Umagengenene, *Scutia myrtina* (Burm.f.) Kurz
Umagoswana, *Cyanotis speciosa* (L.f.) Hassk.
Umagwaqane, *Croton sylvaticus* Hochst.
Umajikanelanga, *Malva parviflora* L.
Umakhunkula, Thymelaceae (Family)
Umakope, *Melolobium candicans* (E.Mey.) Eckl. & Zeyh.
Umakutula, *Noltea africana* (L.) Rchb.f.
Umalala, *Bulbine narcissifolia* Salm-Dyck
Umambomba, *Amaranthus hybridus* L.
Umambumbu, *Amaranthus hybridus* L., *A. thunbergii* Moq.
Umamfobe, *Rhamnus prinoides* L'Hér.
Umamtola, *Diclis reptans* Benth.
Umamtolo, *Hypochoeris radicata* L.
Umanaye, *Ekebergia capensis* Sparrm.
Umangalisa, *Chenopodium ambrosioides* L.
Umanxasana, *Crabbea hirsuta* Harv.
Umanzambomvu, *Bulbine alooides* (L.) Willd.
Umanzamnyama, *Acalypha* sp.
Umanzani, *Syzygium gerrardii* (Harv. ex Hook.f.) Burtt Davy
Umaphipha, *Schotia latifolia* Jacq., *Rapanea melanophloeos* (L.) Mez
Umaqana, *Bowiea volubilis* Harv. ex Hook.f.
Umarhobobo, *Sonchus asper* (L.) Hill
Umasendenja, *Cryptocarya woodii* Engl.
Umaseti, *Taraxacum officinale* Weber (sens. lat.)
Umasibele, *Deinbollia oblongifolia* (E.Mey.ex Arn.) Radlk.
Umasikeyi, *Hieracium* sp.
Umasixabane, *Scilla* sp.
Umatapile, *Belnia reticulata* (Thunb.) Didr., *Zantedeschia albomaculata* (Hook.) Baill. subsp. *albomaculata*, *Z.* sp.
Umathamnandi, *Kiggelaria africana* L., *Vernonia mespilifolia* Less.
Umathola, *Tarchonanthus camphoratus* L.
Umathuma, *Haemanthus albiflos* Jacq., *Solanum* sp.
Umathunga, *Asparagus africanus* Lam., *Haemanthus albiflos* Jacq., *H.* sp.
Umatshinintshina, *Plumbago auriculata* Lam.
Umavumbuka, *Ganoderma* sp., *Sarcophyte sanguinea* Sparrm.
Umaweni, *Haemanthus* sp.
Umayibuye, *Osteospermum calendulaceum* L.f.
Umayisake, *Cissampelos capensis* L.f., *C. torulosa* E.Mey. ex Harv.
Umazolwane entlwathi, *Lichtensteinia* sp.
Umbaba, *Calodendrum capense* (L.f.) Thunb.
Umbabazane, *Urtica dioica* L., *U.* sp., *U. urens* L.
Umbandi, *Garcinia gerrardii* Harv. ex Sim, *Memecylon bachmannii* Engl.
Umbandlala, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) H.Wolff
Umbangabanga, *Deinbollia oblongifolia* (E.Mey. ex Arn.) Radlk., *Solanum mauritianum* Scop.
Umbangalala, *Eriosema squarrosum* (Thunb.) Walp.
Umbangandlala, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *arborescens*
Umbangandlela, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *arborescens*
Umbangaza, *Diospyros* sp., *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) H.Wolff
Umbangeza, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) H.Wolff
Umbatha, *Calodendrum capense* (L.f.) Thunb.
Umbelebele, *Sarcostemma viminale* (L.) R.Br.
Umbelwane, *Eugenia zeyheri* Harv.
Umbenele, *Sarcostemma viminale* (L.) R.Br.
Umbengele, *Macaranga capensis* (Baill.) Benth. ex Sim, *Sapium ellipticum* (Krauss) Pax, *Trema orientalis* (L.) Blume

Umbethe, *Calpurnia aurea* (Aiton) Benth. subsp. *sylvatica* (Burch.) Brummitt, *C. glabrata* Brummitt, *C.* sp., *Commelina africana* L., *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy
Umbethe wethafa, *Schkuhria pinnata* (Lam.) Cabrera
Umbethu, *Clutia* sp.
Umbezo, *Andrachne ovalis* (Sond.) Müll.Arg., *Clutia* sp.
Umbhenya, *Salix capensis* Thunb.
Umbheso, *Clutia pulchella* L.
Umbhovu, *Lycium* sp.
Umbikicane, *Chenopodium ambrosioides* L., *C. murale* L.
Umbinda, *Garcinia gerrardii* Harv. ex Sim
Umbindi, *Oxyanthus speciosus* DC. subsp. *gerrardii* (Sond.) Bridson
Umbinza, *Halleria lucida* L.
Umbiza, *Thesium* sp.
Umbomvane, *Cassine aethiopica* Thunb., *C. peragua* L. subsp. *peragua*, *Elaeodendron croceum* (Thunb.) DC., *Olinia radiata* J.Hofmeyr & E.Phillips
Umbona wemfene, *Zantedeschia albomaculata* (Hook.) Baill. subsp. *albomaculata*, *Z. aethiopica* (L.) Spreng.
Umbone, *Zea mays* L.
Umbongisa, *Diospyros austro-africana* De Winter, *D. dichrophylla* (Gand.) De Winter, *D. lycioides* Desf., *D. pallens* (Thunb.) F.White, *D. simii* (Kuntze) De Winter, *D. whyteana* (Hiern) F.White
Umbongolo, *Sapium ellipticum* (Krauss) Pax
Umbotshane, *Ehretia rigida* (Thunb.) Druce
Umbotshani, *Ehretia rigida* (Thunb.) Druce
Umbovini, *Myrsine africana* L.
Umbovu, *Cassine aethiopica* Thunb., *Hermannia coccocarpa* (Eckl. & Zeyh.) Kuntze, *Lycium ferocissimum* Miers
Umbuhlungu, *Peucedanum* sp.
Umbulunyate, *Osyris lanceolata* Hochst. & Steud.
Umbulunyathi, *Colpoon compressum* P.J.Bergius
Umbumbu, *Clutia pulchella* L.
Umbumbu omncinci, *Clutia heterophylla* Thunb.
Umbumbulu, *Vitellariopsis marginata* (N.E.Br.) Aubrév.
Umbuyabatwa, *Chenopodium* sp.
Umcacabane, *Premna mooiensis* (H.Pearson) G.Piep.
Umcandathambo, *Allophyllus decipiens* (Sond.) Radlk.
Umchakuva, *Ricinus communis* L.
Umchane, *Rhus lucida* L.
Umcheya, *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb.
Umconci, *Schotia afra* (L.) Thunb.
Umdakana, *Apodytes dimidiata* E.Mey. ex Arn., *Canthium ciliatum* (Klotzch) Kuntze
Umdakane, *Apodytes dimidiata* E.Mey. ex Arn.
Umdambiso, *Senecio speciosus* Willd.
Umdenze, *Senecio deltoideus* Less.
Umdiliya, *Vitis vinifera* L.
Umdiza wethafa, *Sida dregei* Burtt Davy
Umdlavuza, *Lauridia tetragonia* (L.f.) R.H.Archer
Umdlebe, *Chionanthus foveolatus* (E.Mey.) Stearn, *Curtisia dentata* (Burm.f.) C.A.Sm.
Umdlesa, *Pavetta lanceolata* Eckl., *Tricalysia lanceolata* (Sond.) Burtt Davy
Umdloli, *Calpurnia aurea* (Aiton) Benth. subsp. *sylvatica* (Burch.) Brummitt
Umdoni, *Syzygium cordatum* Hochst.
Umdono, *Commiphora mossambicensis* (Oliv.) Engl.
Umdubi, *Combretum* sp.
Umdubo, *Combretum erythrophyllum* (Burch.) Sond.
Umdubu, *Combretum caffrum* (Eckl. & Zeyh.) Kuntze, *C. erythrophyllum* (Burch.) Sond.
Umdubu wehlathi, *Combretum kraussii* Hochst.
Umduduma, *Phytolacca dodecandra* L'Hér.
Umduma, *Kiggelaria africana* L.
Umdumizulu ibangana, *Asparagus africanus* Lam.
Umemezi, *Calodendrum capense* (L.f.) Thunb., *Cassipourea flanaganii* (Schinz) Alston., *Rapanea melanophloeos* (L.) Mez
Umfanathenkqi, *Chenopodium* sp.
Umfanoqinile, *Chenopodium murale* L.
Umfanothenkqi, *Aizoon glinoides* L.f.
Umfanujacile, *Argyrolobium* sp.
Umfanuthenkqi, *Chenopodium murale* L.
Umfanuthinqi, *Galenia secunda* (L.f.) Sond.
Umfayenkomo, *Kiggelaria africana* L.
Umfayisele wehlathi, *Portulacaria afra* Jacq.
Umfayisele yasehlatini, *Kalanchoe rotundifolia* (Haw.) Haw.
Umfazi onengxolo, *Hippobromus pauciflorus* (L.f.) Radlk.
Umfazi unengxolo, *Conyza scabrida* DC.
Umfazi, *Streptocarpus rexii* (Hook.) Lindl.
Umfeze, *Croton sylvaticus* Hochst.
Umfincafincane, *Burchellia bubalina* (L.f.) Sims, *Leonotis leonurus* (L.) R.Br., *L. ocymifolia* (Burm.f.) Iwarsson, *Leucas martinicensis* (Jacq.) R.Br.
Umfincafincane wehlathi, *Burchellia bubalina* (L.f.) Sims
Umfincane, *Leonotis ocymifolia* (Burm.f.) Iwarsson
Umfincane wehlati, *Burchellia bubalina* (L.f.) Sims
Umfingo ubuhlungu benyoka, *Raphionacme* sp.
Umfingwani, umncuma, *Stangeria eriopus* (Kunze) Baill.
Umfiyo, *Clutia pulchella* L.
Umfofofo, *Schotia brachypetala* Sond.
Umfuto, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Umgalagala, *Buxus macowanii* Oliv., *B. natalensis* (Oliv.) Hutch.
Umgana, *Chamaecrista capensis* (Thunb.) E.Mey.
Umgcebha, *Rhoicissus digitata* (L.f.) Gilg & Brandt, *R.* sp.
Umgcunube, *Rubus rigidus* Sm., *Salix capensis* Thunb
Umgeya, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb., *P. latifolius* (Thunb.) R.Br. ex Mirb.
Umgezisa, *Cassonia spicata* Thunb., *Schefflera umbellifera* (Sond.) Baill.
Umgilane, *Pseudognaphalium luteo-album* (L.) Hilliard & B.L.Burtt
Umglindi, *Noltea africana* (L.) Rchb.f.
Umgobeleweni, *Agapanthus praecox* Willd.
Umgobogobo, *Plectranthus barbatus* Andr.
Umgogoni, *Aristida junciformis* Trin. & Rupr.
Umgonge, *Schotia afra* (L.) Thunb.
Umgonogono, *Psychotria capensis* (Eckl.) Vatke
Umgqalagquzu, *Allophyllus natalensis* (Sond.) De Winter
Umgqamagqama, *Boscia oleoides* (Burch. ex DC.) Toelken
Umgqeba, *Brachylaena ilicifolia* (Lam.) E.Phillips & Schweick.
Umgqomagqoma, *Nicotiana glauca* Graham
Umgqomogqomo, *Boscia albitrunca* (Burch.) Gilg & Benedict
Umgqukunqa, *Olea woodiana* Knobl.
Umgqukunqa uzintlu, *Ozoroa* sp.
Umgube, *Rothmannia globosa* (Hochst.) Keay
Umgugunga, *Diospyros whyteana* (Hiern) F.White
Umgulugula, *Strychnos madagascariensis* Poir.
Umgumabela, *Rhus discolor* E.Mey. ex Sond.
Umgupa, *Rothmannia globosa* (Hochst.) Keay
Umguza, *Encephalartos altensteinii* Lehm., *E. villosus* Lehm.
Umguzane, *Hibiscus trionum* L.
Umguzani, *Encephalartos* sp.
Umgwali, *Euclea crispa* (Thunb.) Guerke, *E. lancea* Thunb., *E. natalensis* A.DC., *E. undulata* Thunb.
Umgwane, *Erythrina latissima* E.Mey.
Umgwaqane, *Croton sylvaticus* Hochst.
Umgwari, *Euclea crispa* (Thunb.) Guerke, *E. undulata* Thunb.
Umgwashu, *Gerbera piloselloides* (L.) Cass.
Umgwebeleweni, *Agapanthus comptonii* Leighton, *A. campanulatus* Leighton, *A.* sp.
Umgwele, *Cliffortia strobilifera* Murray
Umgwenye, *Ekebergia capensis* Sparrm., *Harpephyllum caffrum* Bernh. ex Krauss
Umgwenye wezinja, *Ekebergia capensis* Sparrm.
Umgwenyehlangula, *Schrebera alata* (Hochst.) Welw.
Umgwenyezinja, *Ficus natalensis* Hochst.
Umgwenyobomvu, *Ekebergia capensis* Sparrm., *Harpephyllum caffrum* Bernh. ex Krauss
Umgwigwi, *Sporobolus pyramidalis* P.Beauv.
Umgxam, *Schotia afra* (L.) Thunb., *S. latifolia* Jacq.
Umgxama, *Schotia latifolia* Jacq.
Umgxina, *Curtisia dentata* (Burm.f.) C.A.Sm.
Umgxobhozo, wetland
Umgxube, *Cassine aethiopica* Thunb., *Coddia rudis* (E.Mey. ex Harv.) Verdc.
Umhlaba, *Alepidea pilifera* Weim., *Aloe ferox* Mill., *A.* sp.
Umhlabangubo, *Bidens pilosa* L., *Buddleja dysophylla* (Benth.) Radlk.
Umhlabelo, *Talinum* sp.
Umhlabelo puntsu, *Talinum* sp.
Umhlabelo ncolo, *Talinum* sp.
Umhlagela, *Drypetes arguta* (Müll.Arg.) Hutch.
Umhlahlapethu, *Chenopodium ambrosioides* L.
Umhlakothi, *Rhus laevigata* L., *R. rehmanniana* Engl.
Umhlakothi omkhulu, *Rhus chirindensis* Baker f.
Umhlakuva, *Ricinus communis* L.
Umhlalamakwaba, *Bridelia micrantha* (Hochst.) Baill.
Umhlamalala, *Strychnos decussata* (Pappe) Gilg

Umhlamba amasi, *Rauvolfia caffra* Sond.
Umhlambamase, *Rauvolfia caffra* Sond.
Umhlambamasi, *Tabernaemontana ventricosa* Hochst. ex A.DC.
Umhlandela, *Kiggelaria africana* L.
Umhlandothi, *Albizia adianthifolia* (Schumach.) W.Wight
Umhlangela, *Drypetes arguta* (Müll.Arg.) Hutch.
Umhlanghoti, *Rhus rehmanniana* Engl.
Umhlangothi, *Rhus laevigata* L.
Umhlangwe, *Maytenus heterophylla* (Eckl. & Zeyh.) N.Robson, *M. nemorosa* (Eckl. & Zeyh.) Marais
Umhlavuthwa, *Datura stramonium* L., *Ricinus communis* L.
Umhlawuvuthwa, *Ricinus communis* L.
Umhlebe, *Olea capensis* L. subsp. *capensis*, *O. capensis* L. subsp. *macrocarpa* (C.H.Wright) I.Verd.
Umhleli, *Ehretia rigida* (Thunb.) Druce
Umhleza, *Pavetta lanceolata* Eckl.
Umhlinzinyati, *Kiggelaria africana* L.
Umhlokotshane, *Rhus crenata* Thunb.
Umhlolo, *Grewia lasiocarpa* E.Mey. ex Harv.
Umhlolowane, *Peristrophe cernua* Nees
Umhlonitshwa, *Indigastrum fastigiatum* (E.Mey.) Schrire, *Psoralea pinnata* L.
Umhlontlo, *Euphorbia* sp., *Euphorbia tetragona* Haw., *E. tirucalli* L., *E. triangularis* Desf.
Umhlonyana, *Artemisia afra* Jacq. ex Willd., *Marrubium vulgare* L., *Rumex acetosella* L.
Umhlonyane, *Cotula anthemoides* L., *Polygala* sp., *Schistostephium lippiifolium* (DC.) Hutch.
Umhlonyane omhlophe, *Artemisia afra* Jacq. ex Willd.
Umhlonyane omncinane, *Matricaria nigellifolia* DC.
Umhlonyane omnyama, *Schistostephium crataegifolium* (DC.) Fenzl ex Harv., *S. flabelliforme* Less.
Umhlonyane wamalawu, *Marrubium vulgare* L., *Matricaria nigellifolia* DC., *Schistostephium flabelliforme* Less.
Umhlonyane wetafa, *Sutera aurantiaca* (Burch.) Hiern
Umhlonyane wethafa, *Sutera* sp.
Umhlonyane womlambo, *Artemisia afra* Jacq. ex Willd., *Matricaria nigellifolia* DC.
Umhlope, *Mimusops caffra* E.Mey. ex A.DC.
Umhluma, *Rhizophora mucronata* Lam.
Umhlungulu, *Ocotea bullata* (Burch.) Baill.
Umhlunguthi, *Commiphora woodii* Engl., *C. harveyi* (Engl.) Engl., *C.* sp.
Umhlwazi, *Catha edulis* (Vahl) Forssk. ex Endl.
Umilolo, *Hibiscus tiliaceus* L.
Umindi, *Mondia whitei* (Hook.f.) Skeels
Umini, *Berchemia zeyheri* (Sond.) Grubov
Umintsane, *Erythrina humeana* Spreng.
Umjela, *Rauvolfia caffra* Sond.
Umjelo, *Rauvolfia caffra* Sond.
Umjinqa, *Aloe tenuior* Haw.
Umjome wehlati, *Syzygium gerrardii* (Harv. ex Hook.f.) Burtt Davy
Umjomi bomva, *Syzygium gerrardii* (Harv. ex Hook.f.) Burtt Davy
Umkakase, *Prunus africana* (Hook.f.) Kalkman
Umkakuva, *Ricinus communis* L.
Umkancaza, *Gardenia thunbergia* Thunb.
Umkangana, *Gardenia thunbergia* Thunb.
Umkangazi, *Gardenia thunbergia* Thunb.
Umkaza, *Euclea natalensis* A.DC., *E. schimperi* (A.DC.) Dandy
Umkhaba, *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb.
Umkhamelo, *Chenopodium* sp.
Umkhangele, *Strychnos decussata* (Pappe) Gilg
Umkhanzi, *Haplocarpha scaposa* Harv., *Schoenoplectus littoralis* (Schrad.) Palla, *Typha domingensis* Pers., *T. capensis* (Rohrb.) N.E.Br.
Umkhaphalanga, *Maytenus acuminata* (L.f.) Loes.
Umkhaza, *Diospyros whyteana* (Hiern) F.White
Umkhiwane, *Ficus ingens* (Miq.) Miq., *F. sur* Forssk.
Umkhoba, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb., *P. latifolius* (Thunb.) R.Br. ex Mirb.
Umkhobeza, *Nuxia congesta* R.Br. ex Fresen.
Umkhokhokho, *Kiggelaria africana* L.
Umkholeya, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb.
Umkhomokhomo, *Dryopteris athamantica* (Kuntze) Kuntze
Umkhondo, *Agapanthus praecox* Willd., *A.* sp., *Clutia pulchella* L., *Cyrtanthus obliquus* (L.f.) Aiton
Umkhothane, *Hypochoeris radicata* L.
Umkhuhlu, *Trichilia dregeana* Sond., *T. emetica* Vahl
Umkhwenkwe, *Pittosporum viridiflorum* Sims
Umkhwinti, *Clutia pulchella* L.
Umkisiso, *Schefflera umbellifera* (Sond.) Baill.
Umkiwane, *Drypetes natalensis* (Harv.) Hutch.
Umkloka, *Erythrina lysistemon* Hutch.
Umkoboti, *Chaetacme aristata* Planch.
Umkombota, *Chaetacme* sp.
Umkomiso, *Protorhus longifolia* (Bernh.) Engl.
Umkovoti, *Chaetacme aristata* Planch.
Umkrakrane, *Aloe tenuior* Haw.
Umkulu, *Rorippa nasturtium-aquaticum* (L.) Hayek
Umkumbati, *Protorhus longifolia* (Bernh.) Engl.
Umkumiso, *Pelargonium reniforme* Curtis
Umkunye, *Millettia grandis* (E.Mey.) Skeels, *M. sutherlandii* Harv., *Olinia ventosa* (L.) Cufod.
Umkupati, *Protorhus longifolia* (Bernh.) Engl.
Umkuwane, *Erythrina latissima* E.Mey.
Umkwane, *Ficus sur* Forssk.
Umkwinde, *Gazania linearis* (Thunb.) Druce
Umkwinti, *Gazania linearis* (Thunb.) Druce, *G. pectinata* (Thunb.) Spreng.
Umlahleni, *Curtisia dentata* (Burm.f.) C.A.Sm.
Umlahleni selefile, *Curtisia dentata* (Burm.f.) C.A.Sm., *Ekebergia capensis* Sparrm.
Umlanjeni, *Plumbago auriculata* Lam.
Umledina, *Ledebouria* sp.
Umleya, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb.
Umlindi, *Rhamnus prinoides* L'Hér.
Umlolwa, *Hibiscus tiliaceus* L.
Umlongo, *Rawsonia lucida* Harv. & Sond.
Umlonhtlo, *Euphorbia grandidens* Haw.
Umlovulovu, *Cordia caffra* Sond.
Umlunge, *Dicoma zeyheri* Sond.
Umlungumabele, *Adenopodia spicata* (E.Mey.) C.Presl, *Zanthoxylum capense* (Thunb.) Harv., *Z. davyi* (I.Verd.) P.G.Waterman
Umluvuluvu, *Cordia caffra* Sond., *Kiggelaria africana* L.
Umnuncwane, *Oxalis corniculata* L., *O. purpurata* Jacq.
Umnake, *Striga elegans* Benth.
Umnambane, Adiantaceae (family)
Umnana, *Maytenus acuminata* (L.f.) Loes.
Umnanja, *Phytolacca octandra* L.
Umncele, *Hyparrhenia dregeana* (Nees) Stapf, *H.* sp.
Umnculuba, *Salix mucronata* Thunb.
Umncwane, *Oxalis* sp., *Rumex lanceolatus* Thunb.
Umnebelele, *Albizia adianthifolia* (Schumach.) W.Wight, *Heywoodia lucens* Sim
Umnewana, *Pelargonium peltatum* (L.) L'Hér.
Umnga, *Acacia karroo* Hayne
Umngamanzi, *Acacia caffra* (Thunb.) Willd.
Umngampunzi, *Acacia karroo* Hayne, *A. robusta* Burch.
Umngana, *Chamaecrista mimosoides* (L.) Greene
Umngcele, *Hyparrhenia hirta* (L.) Stapf
Umngcondo, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb.
Umngcumube, *Salix mucronata* Thunb.
Umngcunube, *Salix babylonica* L., *S. capensis* Thunb, *S. mucronata* Thunb., *Schinus molle* L.
Umngqangqa, *Ficus natalensis* Hochst., *Pleurostylia capensis* (Turcz.) Loes.
Umngqege, *Ficus natalensis* Hochst.
Umngqi, *Maytenus peduncularis* (Sond.) Loes.
Umngqunquti, *Strychnos mitis* S.Moore
Umngumaswile, *Vepris lanceolata* (Lam.) G.Don
Umnguni, *Scolopia mundii* (Eckl. & Zeyh.) Warb.
Umngwavu, *Encephalartos* sp.
Umngxam, *Ficus* sp.
Umnikandiba, *Zanthoxylum capense* (Thunb.) Harv.
Umninawa, *Salvia* sp.
Umnofunofu, *Cordia caffra* Sond.
Umnono, *Strychnos henningsii* Gilg
Umnonono, *Celtis africana* Burm.f., *Strychnos henningsii* Gilg, *S. spinosa* Lam., *Xymalos monospora* (Harv.) Baill. ex Warb.
Umnovunovu, *Cordia caffra* Sond., *Kiggelaria africana* L.
Umnqabane, *Trimeria grandifolia* (Hochst.) Warb.
Umnqabaza, *Grewia occidentalis* L., *G. robusta* Burch.
Umnqanga, *Pleurostylia capensis* (Turcz.) Loes.
Umnqanqa, *Scolopia mundii* (Eckl. & Zeyh.) Warb.
Umnqathe, *Xysmalobium orbiculare* (E.Mey.) D.Dietr.
Umnqayi, *Cassine aethiopica* Thunb., *Maytenus peduncularis* (Sond.) Loes.
Umnqayi masende, *Rawsonia lucida* Harv. & Sond.
Umnqayi weputi, *Rawsonia lucida* Harv. & Sond.

Umnqayimasende, *Cryptocarya woodii* Engl.
Umnqayinqayi, *Maytenus peduncularis* (Sond.) Loes.
Umnqaza, *Grewia occidentalis* L.
Umnquma, *Cryptocarya woodii* Engl., *Euclea crispa* (Thunb.) Guerke, *Olea europaea* L. subsp. *africana* (Mill.) P.S.Green
Umnquma isiwili, *Olea capensis* L. subsp. *capensis*
Umnqumaswile, *Vepris lanceolata* (Lam.) G.Don
Umnqumaswili, *Olea capensis* L. subsp. *capensis*
Umnqundu wenyathi, *Exomis microphylla* (Thunb.) Aellen
Umnqwane, *Erythrina latissima* E.Mey., *Protea* sp.
Umntla, northern aspect
Umntunzi, *Mimusops caffra* E.Mey. ex A.DC., *M. obovata* Sond.
Umntunzi wehlathi, *Mimusops obovata* Sond.
Umnukambiba, *Clausena anisata* (Willd.) Hook.f. ex Benth., *Hippobromus pauciflorus* (L.f.) Radlk.
Umnukambile, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Umnukane, *Ocotea bullata* (Burch.) Baill.
Umnumbithi, *Ocotea bullata* (Burch.) Baill.
Umnunge, *Gladiolus* sp.
Umnungumabele, *Rhus discolor* E.Mey. ex Sond., *Zanthoxylum davyi* (I.Verd.) P.G.Waterman
Umnungwamabele, *Zanthoxylum capense* (Thunb.) Harv.
Umnweba, *Mimusops caffra* E.Mey. ex A.DC., *Sideroxylon inerme* L.
Umnwele, *Cliffortia* sp., *C. strobilifera* Murray, *Passerina* sp., *Sutherlandia frutescens* (L.) R.Br.
Umnxeba, *Mikania natalensis* DC., *Rhoicissus rhomboidea* (E.Mey. ex Harv.) Planch., *R. tridentata* (L.f.) Wild & R.B.Drumm. subsp. *cuneifolia* (Eckl. & Zeyh.) Urton, *R. tridentata* (L.f.) Wild & R.B.Drumm. subsp. *tridentata*
Umnyamanzi, *Acacia caffra* (Thunb.) Willd.
Umnyamati, *Ekebergia capensis* Sparrm.
Umnyana, *Chamaecrista mimosoides* (L.) Greene
Umnyanja, *Phytolacca heptandra* Retz.
Umnyenye, *Rhamnus prinoides* L'Hér.
Umnyushulube, *Canthium* (generic), *C. ciliatum* (Klotzsch) Kuntze, *C. inerme* (L.f.) Kuntze
Umofunofu, *Kiggelaria africana* L.
Umoto, *Clutia heterophylla* Thunb.
Umpafa, *Ptaeroxylon obliquum* (Thunb.) Radlk.
Umpahla, *Brachylaena discolor* DC.
Umpanzi, *Olinia radiata* J.Hofmeyr & E.Phillips, *O. ventosa* (L.) Cufod.
Umpapane, *Trachyandra revoluta* (L.) Kunth
Umpatha, *Brachylaena discolor* DC.
Umphafa, *Melia azedarach* L., *Ziziphus mucronata* Willd.
Umphanga, *Encephalartos* sp., *E. villosus* Lehm
Umphazite, *Margaritaria discoidea* (Baill.) Webster
Umphemba, *Ozoroa mucronata* (Bernh. ex Krauss) R. & A.Fern.
Umphompho, *Eucomis comosa* (Houtt.) Wehrh.
Umphompho wezinja, *Scadoxus puniceus* (L.) Friis & Nordal
Umphunzisa, *Boscia oleoides* (Burch. ex DC.) Toelken, *Maerua racemulosa* (A.DC.) Gilg & Benedict
Umphunzito, *Margaritaria discoidea* (Baill.) Webster
Umpitshi wehlati, *Rawsonia lucida* Harv. & Sond.
Umpofu, *Agapanthus praecox* Willd.
Umponyane, *Pavetta lanceolata* Eckl.
Umpoqoza, *Rabdosiella calycina* (Benth.) Codd
Umpungempu, *Nicandra physalodes* (L.) Gaertn.
Umpunzisa, *Maerua cafra* (DC.) Pax
Umpunziso, *Maerua cafra* (DC.) Pax, *M. racemulosa* (A.DC.) Gilg & Benedict
Umqagula, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken
Umqalothi, *Strychnos henningsii* Gilg
Umqangazani, *Clerodendrum glabrum* E.Mey.
Umqaphula, *Scutia myrtina* (Burm.f.) Kurz
Umqapuna, *Scutia myrtina* (Burm.f.) Kurz
Umqaqoba, *Maytenus heterophylla* (Eckl. & Zeyh.) N.Robson, *Putterlickia pyracantha* (L.) Szyszyl., *Schotia afra* (L.) Thunb., *Scolopia zeyheri* (Nees) Harv.
Umqcwimbe, *Salix mucronata* Thunb.
Umqele, *Dicoma zeyheri* Sond.
Umqhaphu, *Asclepias gibba* (E.Mey.) Schltr., *Scaevola plumieri* (L.) Vahl
Umqokolo, *Dalbergia armata* E.Mey., *Dovyalis caffra* (Hook.f. & Harv.) Hook.f., *D. lucida* Sim, *D. rhamnoides* (Burch. ex DC.) Harv., *D. rotundifolia* (Thunb.) Thunb. & Harv., *D. zeyheri* (Sond.) Warb., *Scolopia zeyheri* (Nees) Harv.
Umqokwane, *Scutia myrtina* (Burm.f.) Kurz
Umqonci, *Schotia afra* (L.) Thunb.
Umqongci, *Trichocladus ellipticus* Eckl. & Zeyh.
Umqumaswele, *Chionanthus foveolatus* (E.Mey.) Stearn
Umqungu, *Cymbopogon excavatus* (Hochst.) Stapf ex Burtt Davy, *C. marginatus* (Steud.) Stapf ex Burtt Davy, *C. validus* (Stapf) Stapf ex Burtt Davy
Umqunye, *Millettia grandis* (E.Mey.) Skeels
Umquqoba, *Schotia afra* (L.) Thunb., *S. zeyheri* (Nees) Harv.
Umqwabaqwaba, *Pelargonium* sp.
Umqwaqu, *Clerodendrum glabrum* E.Mey.
Umqwaqwanam, *Clerodendrum glabrum* E.Mey.
Umqwashu, *Sideroxylon inerme* L.
Umqwashube, *Cunonia capensis* L.
Umrateni omhlophe, *Allium* sp.
Umredeni omhlophe, *Ledebouria cooperi* (Hook.f.) Jessop, *L. undulata* (Jacq.) Jessop, *Ornithogalum conicum* Jacq., *O. longibracteatum* Jacq., *O. tenuifolium* F.Delaroche, *O. thyrsoides* Jacq.
Umrhwaxube, *Cunonia capensis* L.
Umrithi, *Themeda triandra* Forssk.
Umsa, *Gerbera piloselloides* (L.) Cass.
Umsalinge, *Melia azedarach* L.
Umsalingwe, *Melia azedarach* L.
Umsange, *Cussonia spicata* Thunb.
Umsangela, *Pelargonium sidoides* DC.
Umsangelo, *Hibiscus malacospermus* (Turcz.) E.Mey. ex Harv.
Umsantsana, *Anthospermum aethiopicum* L.
Umsenge, *Cussonia paniculata* Eckl. & Zeyh., *C. spicata* Thunb., *Schefflera umbellifera* (Sond.) Baill.
Umsengilazane, *Sporobolus pyramidalis* P.Beauv.
Umserinyeni, *Melia azedarach* L.
Umshala wesandla, *Eleusine coracana* (L.) Gaertn. subsp. *africana* (K.-O'Byrne) Hilu & De Wet
Umshwaqa, *Scolopia mundii* (Eckl. & Zeyh.) Warb.
Umsila wengwe, *Gnidia capitata* L.f., *G.* sp.
Umsilingi, *Tecomaria capensis* (Thunb.) Spach
Umsimbithi, *Millettia grandis* (E.Mey.) Skeels
Umsimbiti, *Millettia grandis* (E.Mey.) Skeels
Umsinde, *Themeda triandra* Forssk.
Umsingilizane, *Sporobolus pyramidalis* P.Beauv.
Umsingizane, *Sporobolus africanus* (Poir.) Robyns & Tournay
Umsingozane, *Tecla natalensis* (Sond.) Engl.
Umsintsi, *Erythrina caffra* Thunb., *E. humeana* Spreng., *E. latissima* E.Mey., *E. lysistemon* Hutch., *E.* sp.
Umsiphane, *Calpurnia* sp., *Clutia pulchella* L.
Umsitshana, *Calodendrum capense* (L.f.) Thunb.
Umsobo, *Nicandra physalodes* (L.) Gaertn., *Solanum burbankii* Bitter, *S. chenopodioides* Lam., *S. nigrum* L., *S. retroflexum* Dun.
Umsobo wamanixwa, *Solanum nigrum* L.
Umsobo wegusha, *Crabbea hirsuta* Harv., *C. nana* Nees
Umsobo wehlathi, *Solanum nigrum* L., *Vernonia mespilifolia* Less.
Umsobo wezinja, *Solanum burbankii* Bitter, *S. chenopodioides* Lam., *S. nigrum* L., *S.* sp.
Umsobosobo, *Phytolacca americana* L., *Solanum nigrum* L., *S. retroflexum* Dun.
Umsola, *Euryops munitus* (L.f.) B.Nord., *Gomphostigma virgatum* (L.f.) Baill.
Umsolo, *Anagallis arvensis* L., *Centella coriacea* Nannfd., *Chaetacanthus setiger* (Pers.) Lindl., *Clutia heterophylla* Thunb., *Falkia repens* L.f., *Matricaria nigellifolia* DC., *Sebaea* sp.
Umsolo omkulu, *Samolus valerandi* L.
Umsolo uwukhubele umlambo, *Ranunculus multifidus* Forssk.
Umsolo webele, *Walafrida geniculata* (L.f.) Rolfe
Umsolo wetafa, *Hermannia flammea* Jacq.
Umsolo womlambo, *Matricaria nigellifolia* DC., *Samolus valerandi* L.
Umsombutyu, *Burchellia bubalina* (L.f.) Sims
Umsondezo, *Scutia myrtina* (Burm.f.) Kurz
Umsongelo, *Pelargonium reniforme* Curtis, *P. sidoides* DC., *P.* sp., *P. zonale* (L.) L' Hér.
Umsonti, *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb., *P. henkelii* Stapf ex Dallim. & Jacks., *P. latifolius* (Thunb.) R.Br. ex Mirb.
Umsu, *Syzygium cordatum* Hochst.
Umsugusu, *Rothmannia globosa* (Hochst.) Keay
Umsulusulu, *Euphorbia* (generic)
Umswi, *Salix capensis* Thunb., *S. mucronata* Thunb., *Syzygium cordatum* Hochst.
Umtala, *Miscanthus capensis* (Nees) Anderss.
Umtane, *Dioscorea cotinifolia* Kunth
Umtekwane, *Leucas* sp.
Umtelele, *Ochna arborea* Burch. ex DC.
Umtenatene, *Diospyros whyteana* (Hiern) F.White
Umtenenenda, *Cola natalensis* Oliv.

Umtetebu, *Cyrtanthus contractus* N.E.Br., *Pelargonium alchemilloides* (L.) L'Hér.
Umthafathafa, *Parmelia* sp., *Usnea* species and coriaceous lichens
Umthathi, *Ptaeroxylon obliquum* (Thunb.) Radlk.
Umthentsema, *Ochna arborea* Burch. ex DC., *Salix capensis* Thunb.
Umthi, *Eriosema kraussiana* Meisn.
Umthi kamaqo, *Plumbago auriculata* Lam.
Umthi kamlanjeni, *Plumbago auriculata* Lam.
Umthi kanomyayi, *Bulbine asphodeloides* (L.) Willd.
Umthi omnandi, *Scabiosa* sp.
Umthi wamadoda, *Plumbago auriculata* Lam.
Umthi wamahilihili, *Senecio macrocephalus* DC.
Umthi wamakhosi, *Schotia latifolia* Jacq.
Umthi wamaqhakuva, *Anthospermum aethiopicum* L.
Umthi wechanti, *Helichrysum calocephalum* Klatt
Umthi wekhokhonathi ioyili, *Aloysia triphylla* (L'Hér.) Britton
Umthi wemibane, *Plumbago auriculata* Lam.
Umthi wenduma, *Hibiscus pedunculatus* L.f.
Umthi wengqele, *Streptocarpus rexii* (Hook.) Lindl.
Umthi wentaka, *Crotalaria agatiflora* Schweinf.
Umthi wetyiphu, *Helichrysum miconiifolium* DC.
Umthi wezulu, *Vernonia natalensis* Sch.Bip. ex Walp.
Umthi wochwane, *Scabiosa africana* L.
Umthimbiti, *Millettia grandis* (E.Mey.) Skeels
Umthole, *Acacia caffra* (Thunb.) Willd.
Umthombe, *Ficus natalensis* Hochst.
Umthombothi, *Acalypha glabrata* Thunb., *Spirostachys africana* Sond.
Umthongothi, *Hyperacanthus amoenus* (Sims) Bridson
Umthothe, *Ptaeroxylon obliquum* (Thunb.) Radlk.
Umthuma, *Solanum aculeastrum* Dun., *Solanum aculeatissimum* Jacq., *S. capense* L., *S. coccineum* Jacq., *S. incanum* L., *S. pseudocapsicum* L., *S. rigescens* Jacq., *S.* sp., *S. tomentosum* L.
Umthuma omkulu, *Solanum aculeastrum* Dun.
Umthuma omncinci, *Solanum incanum* L., *S. rigescens* Jacq.
Umthumawezinja, *Solanum pseudocapsicum* L.
Umthungulu, *Carissa haematocarpa* (Eckl.) A.DC., *C. macrocarpa* (Eckl.) A.DC.
Umthungwa, *Clutia pulchella* L., *Cryptocarya latifolia* Sond., *C. myrtifolia* Stapf, *C. woodii* Engl.
Umthungwane, *Englerophytum natalense* (Sond.) T.D.Penn.
Umthunyelwa, *Pleurostylia capensis* (Turcz.) Loes.
Umthunzi, *Asparagus africanus* Lam.
Umtiza, *Millettia grandis* (E.Mey.) Skeels, *Umtiza listeriana* Sim
Umtomvane, *Smodingium argutum* E.Mey. ex Sond.
Umtomvi, *Viscum* sp., *Voacanga thouarsii* Roem. & Schult.
Umtongwani, *Englerophytum natalense* (Sond.) T.D.Penn.
Umtotova, *Cephalaria decurrens* (Thunb.) Roem. & Schult.
Umtshayelo, *Calopsis paniculata* (Rottb.) Desv.
Umtshekesane, *Euclea natalensis* A.DC.
Umtshekisana, *Aster bakeranus* Burtt Davy ex C.A.Sm., *Euclea natalensis* A.DC.
Umtshekisane, *Asclepias crispa* P.J.Bergius, *Euclea divinorum* Hiern, *E. natalensis* A.DC., *Euclea* sp.
Umtshiki, *Eragrostis plana* Nees, *Sporobolus africanus* (Poir.) Robyns & Tournay
Umtuma, *Solanum sodomaeodes* Kuntze
Umtundisa, *Ranvolfia caffra* Sond.
Umtungwa, *Ocotea bullata* (Burch.) Baill.
Umtunzi, *Minusops caffra* E.Mey. ex A.DC., *M. obovata* Sond.
Umtuto, *Clausena anisata* (Willd.) Hook.f. ex Benth.
Umtwana womlambo, *Samolus valerandi* L.
Umtwane womlambo, *Plantago major* L.
Umtyetyembane, *Premna mooiensis* (H.Pearson) G.Piep.
Umtyityi, *Lencosidea sericea* Eckl. & Zeyh.
Umtyongi, *Antidesma venosum* E.Mey. ex Tul.
Umtyshone, *Diospyros natalensis* (Harv.) Brenan
Umtyutyu, *Amaranthus hybridus* L.
Umula, *Limeum aethiopicum* Burm.
Umuncamunca, *Leonotis ocymifolia* (Burm.f.) Iwarsson
Umunchu, *Oxalis corniculata* L.
Umuncwane, *Leonotis ocymifolia* (Burm.f.) Iwarsson, *Oxalis semiloba* Sond., *O. smithiana* Eckl. & Zeyh.
Umuncwane wethafa, *Pelargonium capitatum* (L.) L'Hér.
Umunyamunya, *Leonotis leonurus* (L.) R.Br.
Umva, *Cannabis sativa* L
Umva womfana, *Tagetes minuta* L.
Umvaganzi, *Trema orientalis* (L.) Blume
Umvane, *Asparagus* sp., *A. stipulaceus* Lam.
Umvawamadoda, *Conyza bonariensis* (L.) Cronquist, *C. canadensis* (L.) Cronquist
Umvawendoda, *Hypochoeris glabra* L.
Umvawenyathi, *Exomis microphylla* (Thunb.) Aellen, *Trichocladus ellipticus* Eckl. & Zeyh.
Umvenyathi, *Exomis microphylla* (Thunb.) Aellen
Umvethi, *Cymbopogon validus* (Stapf) Stapf ex Burtt Davy, *Kiggelaria africana* L., *Xymalos monospora* (Harv.) Baill. ex Warb.
Umveti, *Kiggelaria africana* L.
Umvila, *Pachystigma venosum* Hochst.
Umvilani, *Grewia occidentalis* L.
Umvilo, *Vangueria infausta* Burch., *V.* sp.
Umvilo wehlati, *Pachystigma venosum* Hochst.
Umvithi, *Asparagus macowani* Baker, *Ochna arborea* Burch. ex DC.
Umvumadoda, *Solanum retroflexum* Dun.
Umvumbangwe, *Datura stramonium* L.
Umvumbengwe, *Datura stramonium* L.
Umvumvu, *Celtis africana* Burm.f., *Trema orientalis* (L.) Blume
Umvusankunzi, *Hermannia incana* Cav.
Umvuthuza, *Alepidea amatymbica* Eckl. & Zeyh., *Clematis brachiata* Thunb., *Knowltonia bracteata* Harv. ex Zahlbr., *Sanicula elata* Buch.-Ham. ex D.Don, *Valeriana capensis* Thunb.
Umvuthwamimi, *Canthium inerme* (L.f.) Kuntze
Umwelela, *Tulbaghia alliacea* L.f., *T.* sp.
Umxamo, *Schotia latifolia* Jacq.
Umxoxozi, *Citrullus lanatus* (Thunb.) Matsum. & Nakai
Umya, *Cannabis sativa* L
Umzane, *Tecla natalensis* (Sond.) Engl.
Umzani, *Vepris lanceolata* (Lam.) G.Don
Umzantsi, southern aspect
Umzekhwa, *Rabdosiella calycina* (Benth.) Codd
Umzi, *Cyperus textilis* Thunb.
Umzimbiti, *Millettia grandis* (E.Mey.) Skeels
Umzitsikama, *Virgilia divaricata* Adamson
Umzombi, *Ficus natalensis* Hochst.
Umzongwane, *Hibiscus pusillus* Thunb.
Umzukuza, *Rothmannia globosa* (Hochst.) Keay
Umzungulu, *Dalbergia obovata* E.Mey.
Umzungulwa, *Maytenus acuminata* (L.f.) Loes.
Undendekwana, *Ficus burtt-davyi* Hutch.
Undenze, *Senecio deltoideus* Less.
Undihlabulele, *Chenopodium ambrosioides* L.
Undilambele, *Canthium mundianum* Cham. & Schltdl.
Undlole, *Calpurnia glabrata* Brummitt
Undlwabiyela, *Cotula heterocarpa* DC.
Undoqa, *Helichrysum pedunculatum* Hilliard & B.L.Burtt
Undunyungu, *Pyracantha* sp.
Ungcana, *Dianthus thunbergii* Hooper, *Drimia anomala* (Baker) Benth.
Ungcaseko, *Massonia* sp.
Ungcilikinde, *Heliophila subulata* Burch. ex DC.
Ungenalahle, *Olinia ventosa* (L.) Cufod.
Ungobogobana, *Ehretia rigida* (Thunb.) Druce
Ungqengendlela, *Plantago major* L.
Ungqengendlelo, *Clutia heterophylla* Thunb.
Ungqenqendlela, *Polygala asbestina* Burch.
Ungunoma, *Eriospermum* sp.
Unobijela, *Ipomoea purpurea* (L.) Roth
Unoboyana, *Diospyros villosa* (L.) De Winter, *Monsonia emarginata* (L.f.) L'Hér.
Unobuthongwana, *Chamaecrista capensis* (Thunb.) E.Mey., *C. mimosoides* (L.) Greene
Unochwayi, *Cotula anthemoides* L., *C. heterocarpa* DC.
Unocwayi, *Lepidium ecklonii* Schrad.
Unodlwabiyele, *Senecio albanensis* DC.
Unofenti, *Hieracium* sp.
Unogxekana, *Aster bakeranus* Burtt Davy ex C.A.Sm.
Unojenti, *Hypochoeris radicata* L.
Unojijwa umangolwane, *Drimia* sp.
Unolabulele, *Cotula anthemoides* L.
Unomabhutyubhutyu, *Richardia brasiliensis* Gomes
Unomadolomade, *Phytolacca americana* L.
Unomanumbane, *Englerodaphne* sp.
Unomashwa, *Conostomium natalense* (Hochst.) Bremek.
Unomatafana, *Indigofera stricta* L.f.
Unomatananga, *Canna indica* L.
Unomatshinotshino, *Blepharis capensis* (L.f.) Pers.
Unomatyumtyum, *Carpobrotus edulis* (L.) L.Bolus, *Myrsiphyllum asparagoides* (L.) Willd.
Unomatyumtyuma, *Lampranthus* sp.

Unomatywabutywabu, *Limeum viscosum* (Gay) Fenzl
Unomaweni, *Aloe arborescens* Mill., *A. maculata* All., *A.* sp., *Begonia sutherlandii* Hook.f.
Unomayepuyepu, *Cotula heterocarpa* DC.
Unombija, *Cynanchum* sp.
Unomcela, *Rhynchosia totta* (Thunb.) DC.
Unomcwetshwana, *Sonchus dregeanus* DC., *Taraxacum officinale* Weber (sens. lat.)
Unomdlobhoyi, *Amaranthus blitoides* S.Watson, *A. deflexus* L., *A. hybridus* L.
Unomgushe, *Gerbera viridifolia* (DC.) Sch.Bip.
Unomlatana, *Rubus ludwigii* Eckl. & Zeyh.
Unomlindana, *Cheilanthes viridis* (Forssk.) Sw.
Unomnqwazana, *Hibiscus trionum* L.
Unomolwana, *Malva parviflora* L.
Unomonti, *Hypochoeris radicata* L.
Unompontshane, *Galinsoga parviflora* Cav., *Nemesia melissifolia* Benth.
Unondlabiyele, *Cotula heterocarpa* DC.
Unondlwabiyele, *Coronopus didymus* (L.) Sm.
Unongotyozana, *Centella coriacea* Nannfd.
Unongotyozane, *Centella eriantha* (Rich.) Drude
Unongqutu, *Rhus incisa* L.f. var. *effusa* (C.Presl) R.Fern.
Unongwe, *Gazania krebsiana* Less.
Unonkangana, *Conyza canadensis* (L.) Cronquist, *C. scabrida* DC.
Unonkotyana, *Hermannia incana* Cav.
Unonyada, *Eriospermum* sp.
Unonyongwana, *Centella coriacea* Nannfd.
Unonyongwane, *Centella coriacea* Nannfd.
Unopeperane, *Wahlenbergia undulata* (L.f.) A.DC.
Unopepilana, *Stachys* sp.
Unopepirana, *Lobelia erinus* L.
Unopilikoko, *Drimia* sp.
Unoranga, *Picris echioides* L.
Unosendana, *Aster bakeranus* Burtt Davy ex C.A.Sm.
Unotabalaza, *Ranunculus multifidus* Forssk.
Unozidehekana, *Aster bakeranus* Burtt Davy ex C.A.Sm.
Unozitholana, *Silene undulata* Aiton
Unozixekana, *Aster bakeranus* Burtt Davy ex C.A.Sm.
Unqabaza, *Grewia occidentalis* L.
Unqengendlebe, *Plantago major* L.
Untandathu, *Galinsoga parviflora* Cav.
Untozwane wehlati, *Peddiea africana* Harv.
Unukayo, *Chenopodium ambrosioides* L., *Tagetes minuta* L.
Unuwathala, *Thalictrum rhynocarpum* Dill. & Rich.
Unwele, *Cliffortia linearifolia* Eckl. & Zeyh.
Unxasana, *Hieracium* sp.
Unyawo lwenkukhu, *Asclepias gibba* (E.Mey.) Schltr., *A. multicaulis* (E.Mey.) Schltr., *Pelargonium caffrum* (Eckl. & Zeyh.) Harv.
Unyelambila, *Psydrax obovata* (Eckl. & Zeyh.) Bridson
Unyenye, *Grewia occidentalis* L., *Rhamnus prinoides* L'Hér.
Unyinge, *Agrimonia procera* Wallr.
Unyongwana, *Centella coriacea* Nannfd.
Unyongwane, *Dicoma anomala* Sond.
Upaqa, *Pelargonium* sp.
Upasmani, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken
Uphakane, *Trema orientalis* (L.) Blume
Uphantsikomga, *Haplocarpha* sp.
Uphiphiyo, *Leucas capensis* (Benth.) Engl.
Uphuluka bempethe, *Talinum caffrum* (Thunb.) Eckl. & Zeyh.
Uphuncuka, *Talinum caffrum* (Thunb.) Eckl. & Zeyh.
Uphuncuka bemphete, *Crassula vaginata* Eckl. & Zeyh., *Talinum caffrum* (Thunb.) Eckl. & Zeyh.
Uphuncuka bemphethe obomvu, *Crassula vaginata* Eckl. & Zeyh.
Uphuzana, *Gunnera perpensa* L.
Upuzana lomfula, *Gunnera perpensa* L.
Upuzi, *Gunnera perpensa* L.
Uqadi, *Clutia pulchella* L.
Uqalo, *Thamnocalamus tessellatus* (Nees) Soderstr. & R.P.Ellis
Uqangazane, *Clerodendrum glabrum* E.Mey.
Uqapula, *Capparis sepiaria* L. var. *citrifolia* (Lam.) Toelken, *Scutia myrtina* (Burm.f.) Kurz
Uqaqaqa, *Cynodon dactylon* (L.) Pers., *C. incompletus* Nees
Uqenqendlela, *Polygala illepida* E.Mey. ex Harv.
Uqhobelo, *Geranium ornithopodon* Eckl. & Zeyh.
Uqobeleweni, *Massonia* sp.
Uqoboqoba, *Osteospermum grandidentatum* DC.
Uqonqunga, *Olea woodiana* Knobl.
Uqota, *Combretum bracteosum* (Hochst.) Brandis ex Engl.
Uqoto, *Combretum bracteosum* (Hochst.) Brandis ex Engl.
Uqudalele, *Taraxacum officinale* Weber (sens. lat.)
Uquntani, *Senecio deltoideus* Less.
Uqupose, *Amaranthus thunbergii* Moq.
Uquwe, *Kalanchoe crenata* (Andr.) Haw.
Uqwangxe, *Olea capensis* L. subsp. *macrocarpa* (C.H.Wright) I.Verd.
Uralijane, *Urtica lobulata* E.Mey. ex Blume, *U. urens* L.
Uralijane wamanxiwa, *Urtica dioica* L., *U. lobulata* E.Mey. ex Blume, *U. urens* L.
Urasi, *Urtica* sp.
Uredeni, *Urginea* sp.
Urhangasi, *Felicia filifolia* (Vent.) Burtt Davy
Urhododo, *Ipomoea purpurea* (L.) Roth
Urhwantsana, *Cyperus pulcher* Thunb.
Urhwantsi, *Cyperus pulcher* Thunb., *C. sexangularis* Nees., *C. textilis* Thunb.
Urhwashu, *Merxmuellera cincta* (Nees) Conert, *M. disticha* (Nees) Conert
Urongxeni, *Moraea polystachya* (Thunb.) Ker Gawl.
Uruba, *Myrsiphyllum ramosissimum* (Baker) Oberm.
Urwashu, *Festuca costata* Nees
Usenga, *Cucurbita pepo* L.
Usihlwabitshi, *Amarantlus hybridus* L.
Usikhikhi, *Salvia scabra* L.f.
Usikolipati, *Dioscorea rupicola* Kunth, *D. sylvatica* (Kunth) Eckl.
Usilevu, *Merxmuellera disticha* (Nees) Conert
Usimbene, *Zehneria scabra* (L.f.) Sond.
Usinga lwamaxhegokazi, *Greyia flanaganii* Bolus
Usinga lamaxhegwazana, *Convolvulus farinosus* L.
Usitorhom, *Cadaba aphylla* (Thunb.) Wild
Usobokhulu, *Physalis viscosa* L.
Usomutyu, *Burchellia bubalina* (L.f.) Sims
Utabatane, *Trimeria grandifolia* (Hochst.) Warb.
Utambuki, *Erythrina humeana* Spreng., *Hyparrhenia* sp., *Miscanthus* sp., *Peucedanum caffrum* (Meisn.) E.Phillips
Utambuki isintsana, *Erythrina acanthocarpa* E.Mey.
Utangazana, *Zehneria scabra* (L.f.) Sond.
Utekaza, *Osyris lanceolata* Hochst. & Steud.
Uthekwane, *Acrotome inflata* Benth.
Uthongothi, *Hyperacanthus amoenus* (Sims) Bridson
Uthulwana, *Pinus* sp.
Uthulwane, *Cupressus* sp.
Uthuvana, *Kedrostis africana* (L.) Cogn.
Uthuvishe, *Kedrostis africana* (L.) Cogn., *K.* sp.
Utobankomo, *Burchellia bubalina* (L.f.) Sims
Utovani, *Smodingium argutum* E.Mey. ex Sond.
Utseweletswele, *Bartsia trixago* L.
Utshesi, *Solanum pseudocapsicum* L.
Utshilo, *Trimeria grandifolia* (Hochst.) Warb.
Utshintshini, *Plumbago auriculata* Lam.
Utsolwane, *Sonchus dregeanus* DC.
Utswelana, *Bulbine abyssinica* A.Rich., *B. asphodeloides* (L.) Willd, *B. frutescens* (L.) Willd., *B.* sp., *Tulbaghia violacea* Harv.
Utsweleni, *Bulbine asphodeloides* (L.) Willd.
Utuvishe, *Kedrostis foetidissima* (Jacq.) Cogn.
Utwyina, *Pterocelastrus tricuspidatus* (Lam.) Sond.
Utyampentyu, Cucurbitaceae
Utyani, Poaceae
Utyumbembe, *Senecio* sp.
Utyuthu, *Amaranthus caudatus* L., *A. deflexus* L., *A. hybridus* L., *A.* sp., *Physalis peruviana* L., *Rorippa fluviatilis* (E.Mey. ex Sond.) Thell., *Tetragonia* sp.
Utyuthu obomvu, *Amaranthus hybridus* L.
Utyuthu umadliwa, *Kedrostis africana* (L.) Cogn.
Utywala, *Pollichia campestris* Aiton
Utywala beentaka, *Geranium canescens* L'Hér.
Utywala behlungulu, *Pollichia campestris* Aiton
Utywala bengcungcu, *Leonotis leonurus* (L.) R.Br.
Utywala bentaka, *Lantana camara* L., *L. rugosa* Thunb., *Rubus pinnatus* Willd.
Uvazo, *Polygala* sp.
Uvelabahleke, *Graderia scabra* (L.f.) Benth.
Uvele ludeke, *Galinsoga parviflora* Cav.
Uvelemonti, *Hypochoeris radicata* L., *Senecio erubescens* Aiton
Uvethe, *Ficus* sp., *Teedia lucida* Rudolphi, *Xymalos monospora* (Harv.) Baill. ex Warb.
Uviluka, *Pachystigma venosum* Hochst.
Uvivane, *Lippia javanica* (Burm.f.) Spreng.
Uvuma, *Rhynchosia harveyi* Eckl. & Zeyh.

Uvuma obomvu, *Ipomoea crispa* (Thunb.) Hallier f.
Uvuma omhlophe, *Convolvulus capensis* Burm.f.
Uvumbangwe, *Datura stramonium* L.
Uwatala, *Rorippa nasturtium-aquaticum* (L.) Hayek
Uxekana, *Aster bakeranus* Burtt Davy ex C.A.Sm.
Uxhobakhulu, *Anemone tenuifolia* (L.f.) DC.
Uxumbukhwekhwe, *Helinus integrifolius* (Lam.) Kuntze
Uyakayakana, *Bulbine abyssinica* A.Rich., *B. asphodeloides* (L.) Willd., *Trachyandra affinis* Kunth
Uzabokwe, *Urginea altissima* (L.f.) Baker
Uzandokwa, *Helichrysum oxyphyllum* DC.
Uzingathi, *Dombeya cymosa* Harv.
Uzintlwa, *Curtisia dentata* (Burm.f.) C.A.Sm., *Olea woodiana* Knobl., *Ozoroa* sp.

Yakayakayana, *Bulbine asphodeloides* (L.) Willd.

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The floristics of Sand Forest in northern KwaZulu-Natal, South Africa

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Keywords: *Cleistanthus schlechteri,* DCA, KwaZulu-Natal, Maputaland, *Newtonia hildebrandtii,* Sand Forest, Tropical Dry Forest, TWINSPAN

ABSTRACT

We use multivariate analyses (ordination and classification) to assess both the floristic uniqueness of the woody vegetation of Sand Forest in relation to a range of other forest types in the region, and the range of variation within Sand Forest. Two broad Sand Forest subtypes and related Ecotonal Forests are described and grouped under the term Tropical Dry Forest, distinct from all evergreen forests in South Africa. Sand Forest, a dry semi-deciduous type in northeastern KwaZulu-Natal is defined by the presence of the canopy dominant *Cleistanthus schlechteri* as well as *Hymenocardia ulmoides, Psydrax fragrantissima, Croton pseudopulchellus* and *Drypetes arguta.* Sand Forests form a cohesive group in both DCA and TWINSPAN analyses, with similar composition of canopy dominants at sampled sites. This implies that ecological functioning is similar across the geographical range in northeastern KwaZulu-Natal. However, turnover of subdominant species between recognisable Sand Forest types emphasizes the need to conserve the full range of extant forests.

INTRODUCTION

Maputaland, the northeastern tip of KwaZulu-Natal (Figure 1), forms the narrow southern portion of a large coastal plain extending up the east coast of Africa as far north as Somalia (Watkeys *et al.* 1993). Maputaland is bordered by Mozambique in the north, the Indian Ocean to the east and the Lebombo Mountains to the west (Moll 1978; Bruton & Cooper 1980). The southern boundary can be drawn from the southern end of the Lebombo Range to the mouth of the St Lucia Estuary (Watkeys *et al.* 1993). The vegetation is a complex mosaic of forest, thicket, savanna and grassland, with a high proportion of endemics (perhaps 40% of woody species) and abrupt local changes in response to soils and climate (Moll 1980).

Despite this botanical importance, the area has only recently been scientifically explored. Bayer, in a 1938 study encompassing the coastbelt and midlands of Zululand, stated : '...there is no doubt that throughout the coastbelt proper, evergreen sub-tropical forest ... is a true climatic climax.' However, moist, evergreen forest is certainly not the only forest type in the region. References to dry forest with a unique complement of species first appear in the literature in the mid-1960's (e.g. Vahrmeijer 1966; Tinley 1967). Moll (1968, 1978, 1980) and Moll & White (1978) used the local term 'Sand Forest' to describe this dry deciduous or semideciduous forest occurring on sandy soils. They list a variety of common and widespread tree species, including *Newtonia hildebrandtii, Cleistanthus schlechteri, Hymenocardia ulmoides, Balanites maughamii, Ptaeroxylon obliquum* and others. The term Sand Forest has since passed into general (e.g. Goodman 1990; Midgley *et al.* 1997) and popular use (e.g. Pooley 1993; Craib 1995). In South Africa, it refers to dense forests with numerous trees and shrubs (De Moor *et al.* 1977; Moll & White 1978; Moll 1978, 1980) with a relatively short canopy (6 m or higher: De Moor *et al.* 1977. 10–25 m: Moll & White 1978; Moll 1978, 1980. 5–13 m with emergents above 15 m: Ward 1981), occurring in dry conditions (600–1 000 mm: Tinley 1967. 700–900 mm: Moll & White 1978) on white to deep red sandy soils (Vahrmeijer 1966; Tinley 1967; De Moor *et al.* 1977; Moll &

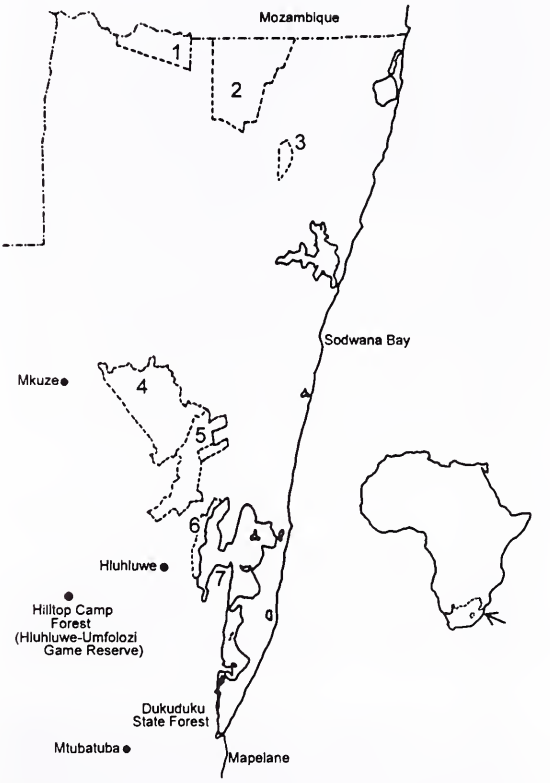

FIGURE 1.—Map of northeastern KwaZulu-Natal showing sampled sites and boundaries of reserves containing Sand Forest. 1, Ndumu Game Reserve; 2, Tembe Elephant Park; 3, Sileza Forest Reserve; 4, Mkuzi Game Reserve; 5, Phinda Resource Reserve; 6, False Bay Park; 7, Hell's Gate.

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White 1978; Moll 1978, 1980; Ward 1981). These forests tend to be patchily distributed in characteristic north-south oriented strips (Vahrmeijer 1966; Moll 1978, 1980; Moll & White 1978; Ward 1981).

Although this forest type is a conspicuous feature in Maputaland (Moll 1978, 1980; pers. obs.), descriptions have been cursory (e.g. Vahrmeijer 1966; Tinley 1967;. Moll 1978, 1980; Moll & White 1978) or very local (e.g. De Moor *et al.* 1977; Ward 1981; Goodman 1990). There is confusion regarding the definition of Sand Forest and which plant species are representative and characteristic (e.g. Moll & White 1978 cf. McKenzie 1996). The published literature describing Sand Forest is confined to a few paragraphs. Species lists associated with this forest type appear to be derived largely from casual observation, and feature conspicuous canopy emergents such as *Newtonia hildebrandtii* and *Balanites maughamii* which may be associated with other vegetation types (pers. obs.). Only one study, based on a regional data set and using quantitative methods, defines Sand Forest types in terms of characteristic tree species (MacDevette *et al.* 1989). However, that work is presented only as a preliminary classification of the KwaZulu-Natal indigenous forests, and is based on species checklists of varying reliability, with whole forests as the basic sample unit.

It is also unclear how closely Sand Forest is related to other forests in the region. Moll (1978, 1980) simply treats Sand Forest as one of thirteen or fifteen vegetation types in Maputaland. Moll & White (1978), in a description of the Indian Ocean Coastal Belt (a floristic zone stretching from just south of Somalia to the Cape), include Sand Forest in the Tongaland-Pondoland Regional Mosaic with four other forest types. Midgley *et al.* (1997) follow this approach and that of White (1983) which emphasizes the separation of the South African forest flora into the Afromontane types and the Tongaland-Pondoland Regional Mosaic which includes Sand Forest. MacDevette *et al.* (1989), in a TWINSPAN classification of the KwaZulu-Natal indigenous forests, group an Eastern and Western Sand Forest type under the title Tropical Dry Forest with four other Coastal Forest types. Their main division separates Coastal Forests from Interior Forests in a similar manner to the treatments described above. Tinley (1967, 1977), however, regards Tropical Dry Semideciduous Forest in South Africa as part of a much larger Southern Tropical Sand Forest Domain, completely separate from all moist evergreen forests (including evergreen coastal forests). Moll & White (1978) list a variety of Sand Forest species linking the Pondoland-Tongaland Regional Mosaic with Dry Forests in the Zanzibar-Inhambane Regional Mosaic, which would seem to support Tinley's approach.

Despite the lack of any comprehensive study of Sand Forest, its conservation in South Africa is considered important for a number of reasons. Sand Forest covers a small total area (McKenzie 1996) and is heavily impacted outside of reserves (Moll 1978; Geldenhuys & MacDevette 1989; McKenzie 1996; pers. obs.). It is rich in woody species (Moll & White 1978) and the habitat of a number of unusual or rare animals, such as the Suni, *Neotragus moschatus* (Lawson 1986), the African broadbill, *Smithornis capensis,* and Neergaard's sunbird, *Nectarinia neergaardi,* which is largely confined to the Sand Forest (Harrison *et al.* 1997). It is a drawcard for tourists (Macfarlane 1993; Craib 1995) and an important local resource, providing a range of building materials, traditional medicines and some food plants (Cunningham 1985).

At present, there is little information available for conservation planning, or for the delimitation of sensible ecological units for management and research into the dynamics of this little known forest type. Human pressure on the natural environment is increasingly severe as improved infrastructure leads to a rapidly increasing rural population. This description is important in ascertaining the conservation worthiness of the forest type as a whole and how well the range of floristic variation is presently conserved. In addition it serves as a basis for further ecological work.

Our aims are: to determine how similar Sand Forest in northern KwaZulu-Natal is to other South African forests, especially the moist evergreen Coastal Forests of KwaZulu-Natal; to define Sand Forest in terms of its woody species composition; and to describe any variation within the Sand Forest type.

STUDY SITE

Maputaland in South Africa is a low coastal plain covering approximately 5 700 km^2 (Watkeys *et al.* 1993). The climate is moist subtropical along the coast where rainfall is over 1 000 mm per annum becoming dry subtropical inland with less than 600 mm per annum. Rainfall increases again to over 800 mm per annum along the crest of the Lebombo Mountains (Maud 1980; Watkeys *et al.* 1993). The highest monthly precipitation falls between September and April resulting in hot, humid summers and cool, dry winters.

The soils of Maputaland are complex, although most of the area is covered by infertile, sandy Tertiary and Quaternary deposits (Watkeys *et al.* 1993). Marine transgressions and regressions since the end of the Cretaceous have formed these deposits into dune ridges oriented in a north-south direction (Goodman 1990), parallel to the present-day coastline. These dune cordons decrease in age from west to east, and the oldest, most westerly dune cordon may date from the Plio-Pleistocene (Davies 1976, cited by Goodman 1990). These oldest palaeo-dunes are not well preserved and are deep red in colour due to advanced mineral diagenesis. The soils on younger, more easterly dunes are generally poorly developed, yellow to orange arenosols. Sand Forest occurs on the full range of these inland dunes. The tall coastal dune cordon is composed of dystrophic pallid sands, with steep slopes stabilised by dune forest and scrub. Between the dune ridges, the coastal plain is flat to gently undulating, and may be covered with loose dystrophic sands (Goodman 1990; Watkeys *et al.* 1993).

METHODS

Data collection

Analyses were based on two data sets, a 'Sand Forest' data subset, sampled specifically for this study, was combined with a regional Northeastern KwaZulu-Natal data set, to allow comparisons among a range of forest types. Sampling was confined to woody vegetation for a number of reasons. Non-woody understorey vegetation is temporally and spatially variable in these seasonally dry forests, and our short-term sampling program could not adequately assess this component. From a practical point of view, we are attempting to delimit ecological units, and it is the trees that most affect the forest environment. In Sand Forest the non-woody component is particulary sparse and contributes little to total biomass. Also, trees, shrubs and lianes are easier to find and identify than grasses and herbs, and we hope this study will be accessable to nonspecialists.

'Sand Forest' Data Set

Forests growing on or near sandy soils in Maputaland (excluding dune forests) were sampled to represent all the so-called Sand or Tropical Dry Forest types mentioned by De Moor *et al.* (1977), Moll (1978, 1980), Moll & White (1978), Ward (1981), MacDevette *et al.* (1989) and Goodman (1990). Sampled sites include the KwaZulu-Natal Nature Conservation Services reserves; False Bay Park, Mkuzi Game Reserve, Tembe Elephant Park, Ndumu Game Reserve and Sileza Forest Reserve, the privately owned Phinda Resource Reserve (hereafter referred to as False Bay, Mkuzi, Tembe, Ndumu, Sileza and Phinda respectively) and relatively undisturbed nearby areas which will be referred to by the same locality names. Protected areas were preferred for this survey as unprotected forests are usually heavily disturbed, complicating the recognition and definition of sand forest types.

At each locality, areas of forest (closed canopy, woody communities, > 5 m, MacDevette *et al.* 1989; Midgley *et al.* 1997) were chosen subjectively to represent the range of variation in structure and species composition. Within these areas, quadrats were randomly located, with the proviso that they be at least 50 m from any previous quadrats and the forest edge. The number of quadrats located at each locality was subjectively determined. Sampling was halted when the variation in species composition was adequately represented. Due to the naturally patchy and discontinuous nature of Sand Forest, which is further fragmented outside of protected areas, a more structured approach was considered impractical.

Samples consisted of circular 400 m^2 quadrats. This is a suitable size for short forest communities (Kent & Coker 1992), representing the approximate point of inflection of a species/area curve within a homogenous area of sand forest (Goodman 1990; D. Kirkwood unpubl. data) and is compatible with samples collected by other workers in the region. Species abundance values in each quadrat are total diameter at breast height (DBH), calculated from the sum of area at breast height of all individuals. DBH of all woody individuals taller than 2 m, rooted within the quadrat was measured. Height of trees shorter than 2 m was measured, and converted to an estimate of diameter from a linear regression of height vs DBH for all trees between 2 and 3 m high at a site. Shrubs (largest individuals usually < 2 m), woody lianes and creepers were assigned an arbitrary total DBH of 2 cm. Tree species names follow Van Wyk & Van Wyk (1997).

Northeastern KwaZulu-Natal Data Set

Data from circular 400 m^2 quadrats sampled in a range of northeastern KwaZulu-Natal forests (see Figure 1) were used. Sites were chosen to represent Coastal and Inland Forest types (sensu MacDevette *et al.* 1989): Mapelane (35 quadrats) and Sodwana (34 quadrats) from the coastal dune cordon and Dukuduku Forest (20 quadrats) correspond to Undifferentiated Coastal Forest (sensu MacDevette *et al.* 1989) (Undifferentiated Lowland Forest sensu Moll & White 1978 or Coastal Forest sensu Lubke & McKenzie 1996) (R. van Wyk, D.R. MacDevette, D. Everard and I. Gordon, unpubl. data). Coast Scarp Forest (sensu MacDevette *et al.* 1989) (Lebombo Forest sensu Moll 1978, 1980), sampled in 1996 around Hluhluwe Game Reserve Hilltop Camp (21 quadrats: A. West, D. Kirkwood & J.J. Midgley unpubl. data), represents the Inland Forests.

These quadrats from coastal and inland types were combined with the 135 quadrats sampled for this study from as wide a range as possible of 'Sand Forest' and related types in Maputaland. This includes 16 quadrats sampled in Hell's Gate, just south of False Bay Park (D. Kirkwood unpubl. data), an area administered by the S.A. National Defence Force. The Hell's Gate quadrats are only included in the regional data set as the forest was substantially different floristically from other Sand Forest/Tropical Dry Forest types.

In this regional data set, abundance values were simplified to presence/absence of species, and small shrub, liane and creeper species were excluded, in order to overcome compatibility problems. While this reduces the information content of the data, it allows the robustness of results from analysis of the 'Sand Forest' data subset to be assessed.

Multivariate analysis

Our classification and definition of forest types, as well as the ordinations of samples are derived from indirect gradient analyses, utilising only floristic data. The most meaningful results were obtained using two well-known, robust and complementary techniques (Gauch 1982; Kent & Coker 1992): Two-Way Indicator Species Analysis (TWINSPAN, Hill 1979), a polythetic, divisive program and the Detrended Correspondence Analysis (DCA) option in the package CANOCO (Ter Braak 1991). These quantitative multivariate techniques were used to analyse the two data sets.

For all TWINSPAN analyses the following defaults were used: 10 indicator species per division and a minimum group size for division of five quadrats. Three lev-

els of division were adequate to separate the regional data set into groups consisting of quadrats largely from one locality. Four levels of division resulted in meaningful final groups used for the detailed classification of the Sand Forest data subset, which has a higher information content. Pseudospecies cut levels for the Sand Forest analysis were set at 0, 2.5, 10, 20 and 40 cm total DBH.

Analyses of the regional data set utilised all quadrats and only presence/absence abundance values were used. For the Sand Forest Data, two outlier plots significantly changed the relationships amongst the remaining plots. These were found to be quadrats in woodland clumps on the margin of sand forest patches in Tembe and Mkuzi and were thus eliminated from the final analysis. Our final classification of Sand Forest and related types is based on TWINSPAN analyses of both the regional and Sand Forest data sets. TWINSPAN, which is based on a reciprocal averaging algorithm, successively divides groups of samples utilising the differential presence or absence of species (Gauch 1982; Kent & Coker 1992). The program identifies indicator species for each division; 'characteristic species' are those which consistently occur in only one of the two groups of samples under consideration; 'preferential species' occur in a greater proportion of samples in one group than in the other.

All quadrats were used in the DCA of the regional data set. Similarly, although the related Hell's Gate Forests were not incorporated, all other Sand Forest/Tropical Dry Forest type quadrats were used in the DCA analyses of the 'Sand Forest' data set. Two separate DCA analyses of the 'Sand Forest' data set were performed. The first uses species abundance values of total DBH. The subsequent analysis uses only presence/absence values to reduce the influence of dominant species.

Dominance

In order to evaluate the relative influence of dominant species on the grouping of Sand Forest quadrats by the DCA, dominance diversity curves were constructed for the six sites sampled. Importance values for these curves were calculated as the average of a species' relative dominance value (species total DBH/locality total DBH) and its relative density (no. plants/total no. plants) over all quadrats sampled in an area, excluding those shown to be outliers in the DCA ordinations. Quadrats sampled from the same area are grouped together by all analyses, with very few exceptions, indicating that forests are locally uniform, and sites can be used as natural units.

RESULTS

Affinities

The first two ordination axes of the detrended correspondence analysis of the northeastern KwaZulu-Natal forests (Figure 2) reveal that the majority of 'Sand Forest' quadrats are more widely separated from Coastal Forest types in Maputaland (Mapelane, Sodwana and Duku-

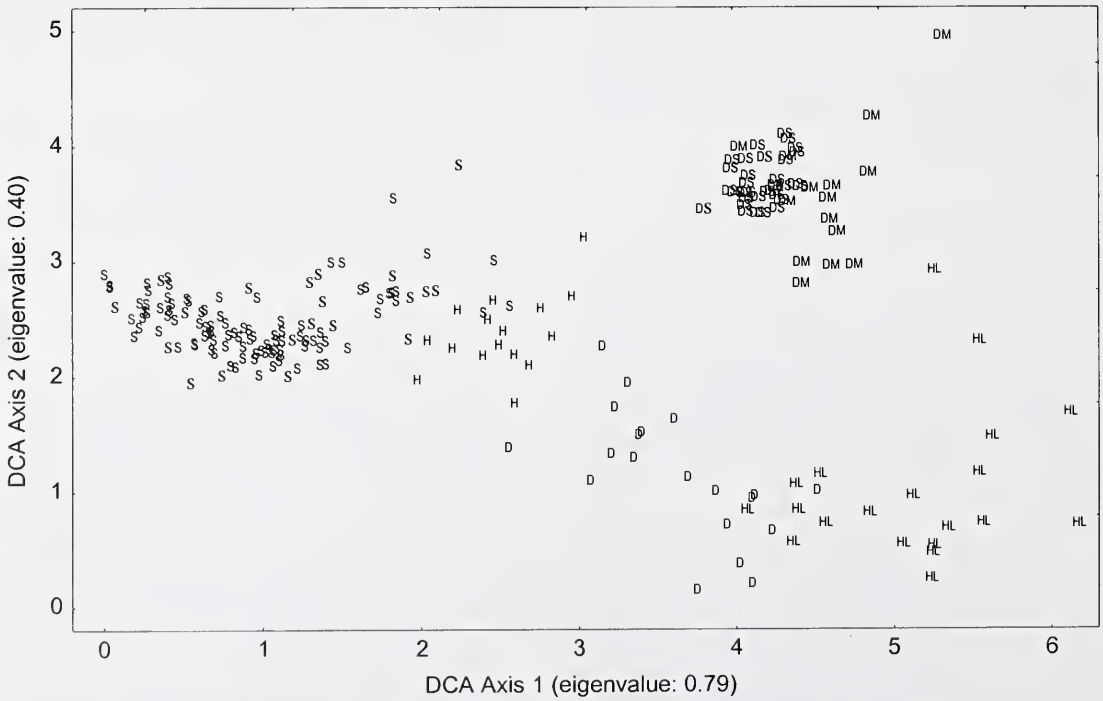


FIGURE 2.—Detrended correspondence analysis ordination of quadrats from a range of northeastern KwaZulu-Natal forests. S, 'Sand Forest' types; H, Hell's Gate; D, Dukuduku Forest; DS, Sodwana Dune Forest; DM, Mapelane Dune Forest; HL, forest around Hluhluwe Hilltop Camp.

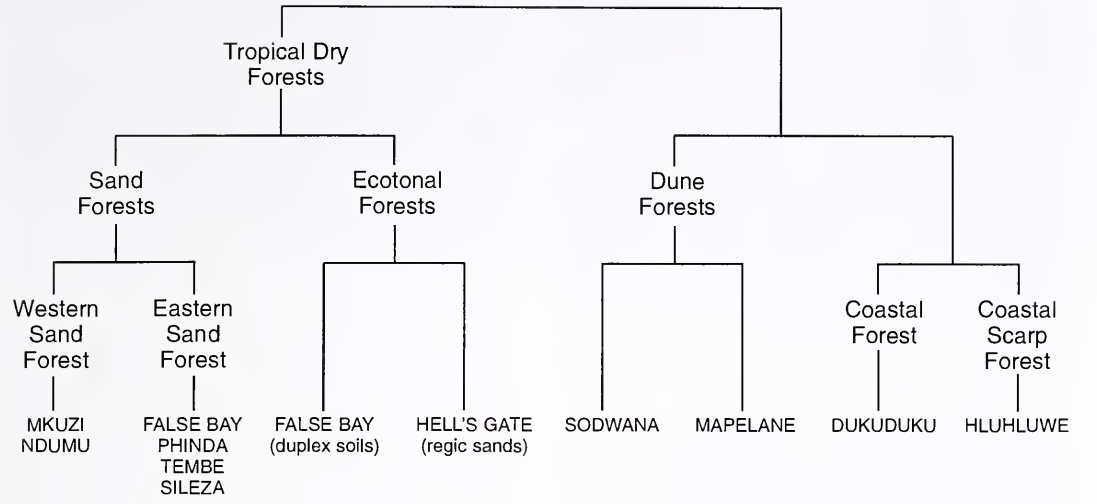


FIGURE 3.—TWINSPAN classification of the northeastern KwaZulu-Natal data set. For clarity, final groups are presented only as locality names, as quadrats from the same locality are consistently grouped together (only 7 exceptions from 234 quadrats).

duku), than these Coastal Forest types are from an Inland Forest type represented by the Hluhluwe Game Reserve locality. Most of the quadrats sampled to represent 'Sand Forest' types form a tight group. Quadrats sampled at Hell's Gate forest and some 'Sand Forest' quadrats are however not closely allied to the other Sand Forest samples, and although distinct, are not widely separated from the Undifferentiated Coastal Forests of Dukuduku.

The TWINSPAN classification of the same data set (Figure 3) emphasizes the separation of samples of 'Sand Forest' and it's allies from those of the moist evergreen Coastal and Interior Forests in the first division (eigenvalue: 0.749).

Classification

In classifying the Sand Forest types we follow the terminology of MacDevette *et al.* (1989), whose group names are sensible and easily remembered. However, it is important to note that the groups are substantially modified and many of our characteristic and representative species differ.

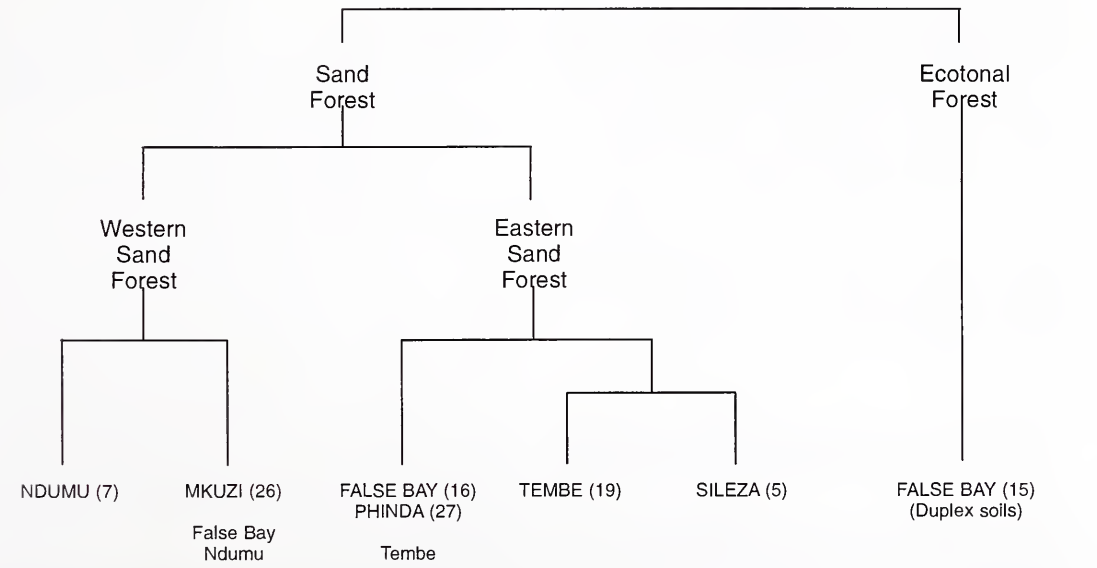


FIGURE 4.—TWINSPAN classification of the Sand Forest data set. The number of quadrats from each area occurring in a final group are indicated in parentheses behind locality names. Lower case place names indicate that one quadrat from that locality occurs in the final group.

TWINSPAN analyses of the regional data set (Figure 3) and the Sand Forest data set (Figure 4) produce completely congruous classifications. Characteristic and preferential species based on divisions 1 and 2 of the regional analysis and divisions 2, 3 and 4 of the Sand Forest analysis are presented in our classification.

We suggest that the term 'Tropical Dry Forest' be used in South Africa to encompass both Sand Forest and allied dry semideciduous forests. Although these forests are strictly subtropical, it seems likely that they are floristically allied and ecologically similar to other Tropical Dry Forests in Africa.

Tropical Dry Forest

This forest type is defined by the presence of the characteristic tree species *Hymenocardia ulmoides, Wrightia natalensis, Pteleopsis myrtifolia, Cleistanthus schlechteri, Newtonia hildebrandtii* and *Drypetes arguta.* Preferential tree species are *Cola greenwayi, Hyperacanthus amoenus, Boscia foetida, Brachylaena huillensis, Combretum mkuzense, Dialium schlechteri, Grewia microthyrsa, Haplocoelum gallense, Monodora junodii, Psydrax fragrantissima, Ptaeroxylon obliquum, Strychnos henningsii, Toddaliopsis bremekampii* and *Tricalysia lanceolata.*

Although we have comprehensively sampled Tropical Dry Forest, only a small range of KwaZulu-Natal forests is used for comparison here. While the tree species characterising Tropical Dry Forest at this level of classification are representative, they may not be definitive when used in comparison with forests not included in this analysis.

Tropical Dry Forest is divided into two subtypes: Sand Forest and Ecotonal Forest (eigenvalue: 0.326).

Ecotonal Forest

These samples, while clearly allied to Sand Forest, are floristically diverse and occur on a variety of soils. Quadrats sampled in False Bay Park on duplex soils and soils with a high clay content fall into this group, as do quadrats on grey regic sands from the Hell's Gate area. Due to the variable species composition of quadrats in this group, we will not define subtypes within this group.

Characteristic tree species are *Strychnos usambarensis* and *Catunaregam spinosa* subsp. *spinosa.* Preferential tree species are *Chaetacme aristata, Diospyros inhacaensis, Drypetes natalensis, Manilkara concolor* and *Strychnos madagascariensis.*

Sand Forest

This type includes the majority of Tropical Dry Forest samples (103 of 143) and forms a cohesive group in the DCA of the regional data set (Figure 2). Most samples occur on base-rich aeolian sands.

Characteristic tree species are *Cleistanthus schlechteri, Hymenocardia ulmoides, Toddaliopsis bremekampii, Psydrax fragrantissima, Pteleopsis myrtifolia* and *Haplocoelum gallense.* Preferential tree species are *Boscia foetida, Combretum mkuzense, Croton gratissimus, Hyperacanthus microphyllus, Monodora junodii* and *Vitex ferruginea* subsp. *amboniensis.*

For further divisions, the results of the TWINSPAN analysis of the Sand Forest data subset are presented. Shrubs and lianes, as well as abundance values for all woody species are recorded in this subset of quadrats. Where a species name is marked with an asterisk or double asterisk, this denotes that a characteristic or preferential species of a group is abundant—total diameter at breast height (DBH) > 20 cm; or very abundant—total DBH > 40 cm. Despite the increased information content of this data set, the TWINSPAN classification of Sand Forest samples (Figure 4) corresponds exactly with the divisions produced using the regional data set (Figure 3).

Sand Forest can be subdivided into two broad types, Western and Eastern Sand Forest (eigenvalue: 0.216).

Western Sand Forest

This type is represented by the Sand Forests from Mkuzi and Ndumu Game Reserves.

Characteristic species are the trees *Croton gratissimus* and *Brachylaena huillensis.* Preferential species include the trees *Brachylaena huillensis**, Combretum mkuzense*, Commiphora neglecta, Craibia zimmermanii, Croton gratissimus*, Gardenia cornuta, Rhus gueinzii* and *Strychnos spinosa*[1], as well as the lianes and creepers *Combretum* sp.[2] and *Grewia caffra.*

Eastern Sand Forest

Eastern Sand Forest includes the samples from False Bay Park, Phinda, Tembe and Sileza.

Characteristic species are the subcanopy trees *Cola greenwayi, Drypetes arguta* and *Tricalysia lanceolata.* Preferential species include the trees: *Balanites maughamii, Cola greenwayi**, Dialium schlechteri, Dovyalis zeyheri, Drypetes arguta*, Erythrophleum lasianthum, Grewia microthyrsa, Haplocoelum gallense*, Hyperacanthus amoenus, Leptactina delagoensis, Manilkara discolor, Ochna arborea, O. natalitia, Oxyanthus latifolius, Psydrax locuples, P. fragrantissima*, Ptaeroxylon obliquum, Strychnos henningsii, Suregada zanzibariensis, Toddaliopsis bremekampii* and *Vitex ferruginea* subsp. *amboniensis.* Other preferential species are the lianes and creepers *Acacia kraussiana, Dalbergia obovata, Landolphia kirkii, Monanthotaxis caffra* and *Synaptolepis kirkii.*

The third level of division in the TWINSPAN classification of the Sand Forest data set (Figure 4) essentially subdivides both the Western (eigenvalue: 0.207) and

[1] Forest growth form, known locally as umHlalakolotshe.
[2] *Combretum* cf. *celastroides*, an unidentified but common climber in these forests.
* abundant, total DBH > 20 cm.
** very abundant, total DBH > 40 cm.

the Eastern (eigenvalue: 0.260) Sand Forest types into groups of samples that reflect species turnover between geographically separate sites. Only quadrats from Phinda and those on sandy soil at False Bay are grouped together. In the fourth and final level of division (not illustrated) it is notable that both the Mkuzi quadrats (Western Sand Forest), and the Phinda/False Bay quadrats (Eastern Sand Forest) are subdivided into groups characterised by the presence or absence of *Newtonia hildebrandtii*. Localised stands dominated by this tree, a large, spreading canopy emergent, are a conspicuous feature of these forests (pers. obs.; Moll & White 1978).

Species turnover and dominance in Sand Forest samples

In a DCA ordination of the same Sand Forest data subset (Figure 5), with species abundance values of total DBH, quadrats are not separated into the groups described above. Samples from False Bay, Mkuzi, Phinda, Tembe and Ndumu are grouped together, with a high degree of overlap within a range of two half changes (each DCA unit or average standard deviation of species turnover is approximately equivalent to a 50% change in species composition of samples, Gauch 1982). Only quadrats from Ecotonal Forest on duplex soils at False Bay and the Sileza samples are clearly separated from the main group. However, when species abundance values are reduced to presence/absence values, the resulting DCA ordination plot (Figure 6), groups quadrats in an identical manner to the final level of the TWINSPAN classification illustrated in Figure 4. This result confirms the validity of the classification. In addition, ground-truthing using this classification outside of sampled areas indicated that we have adequately covered the range of variation of Sand Forest in Maputaland.

Separation of Sand Forest subtypes in the DCA ordination presented in Figure 6 results from reducing the influence of dominant species. This implies that within the Sand Forest type, forests have similar dominant species, but there is significant turnover of the less common species between groups. Dominance-diversity curves at each locality (Figure 7) indicate that this is the case. *Cleistanthus schlechteri* and *Newtonia hildebrandtii* rank consistently high. Note the disparity between the importance values of the one or two most dominant species and the other species at most sites.

Although the division between Western and Eastern Sand Forest is justified and convenient, it seems that the most natural grouping of forests is into three groups: the Mkuzi/Ndumu Group, separated from all other samples on the first and third DCA axes in Figure 6, and the Phinda/False Bay Group separated from the Tembe/Sileza Group on the second axis. These groups may represent a soil gradient, from the oldest red sands of Western Mkuzi/Ndumu Group, through orange to yellow sands of Sand Forests at Phinda and False Bay Park, to the predominantly yellow to white sands of Tembe and Sileza. The samples at Sileza, an isolated forest occurring on dystrophic white sands and surrounded by *Hyphaene natalensis* Palm Veld, although included in Eastern Sand

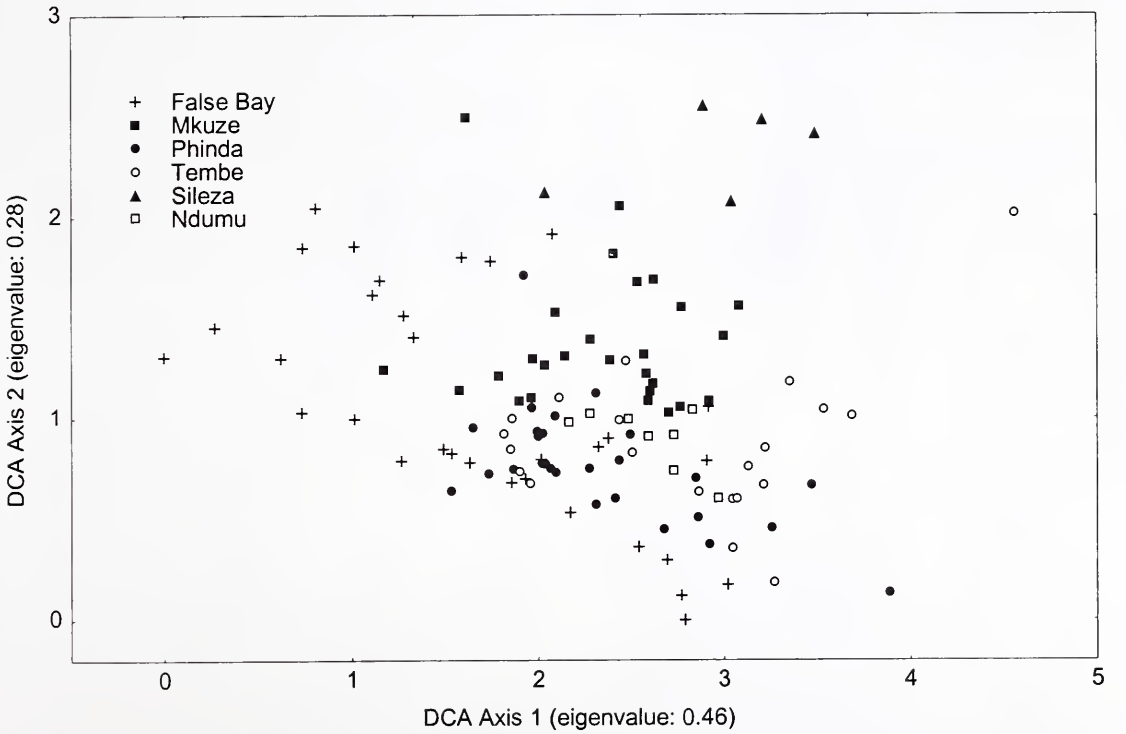


FIGURE 5.—Detrended correspondence analysis ordination of Sand Forest and associated quadrats utilising species abundance values of total diameter at breast height (DBH). Further axes do not reveal identifiable groups.

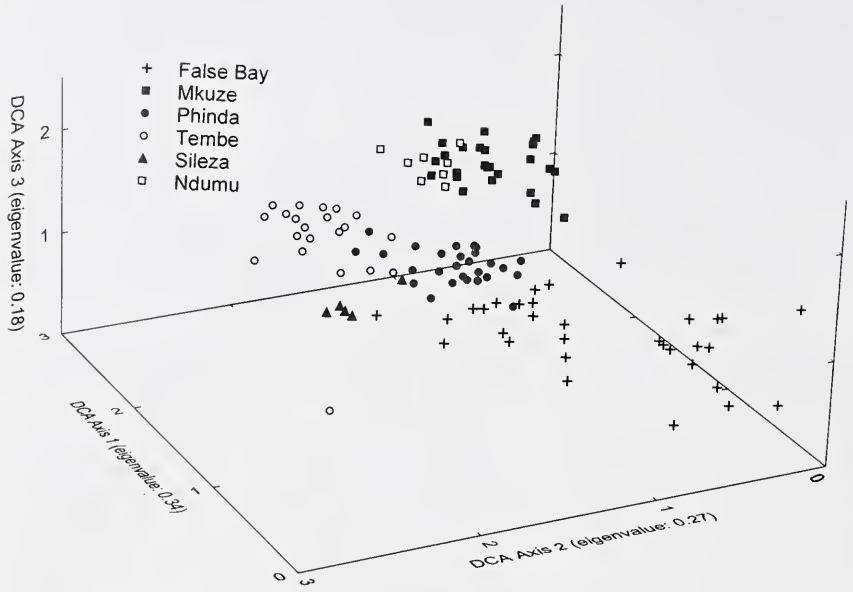


FIGURE 6.—Detrended correspondence analysis ordination of Sand Forest and associated quadrats utilising only species presence or absence (cf. Figure 5).

Forest, are separated from other Sand Forests by all DCAs and should not be considered typical.

A sample by species table of the Sand Forest data set is presented in Table 1 with a complete species list for all the localities sampled. Importance value classes in the table matrix represent total stem diameter at breast height for a species: 1 = 0–2.5 cm DBH, 2 = 2.5–10 cm DBH, 3 = 10–20 cm DBH, 4 = 20–40 cm DBH, 5 = > 40 cm DBH.

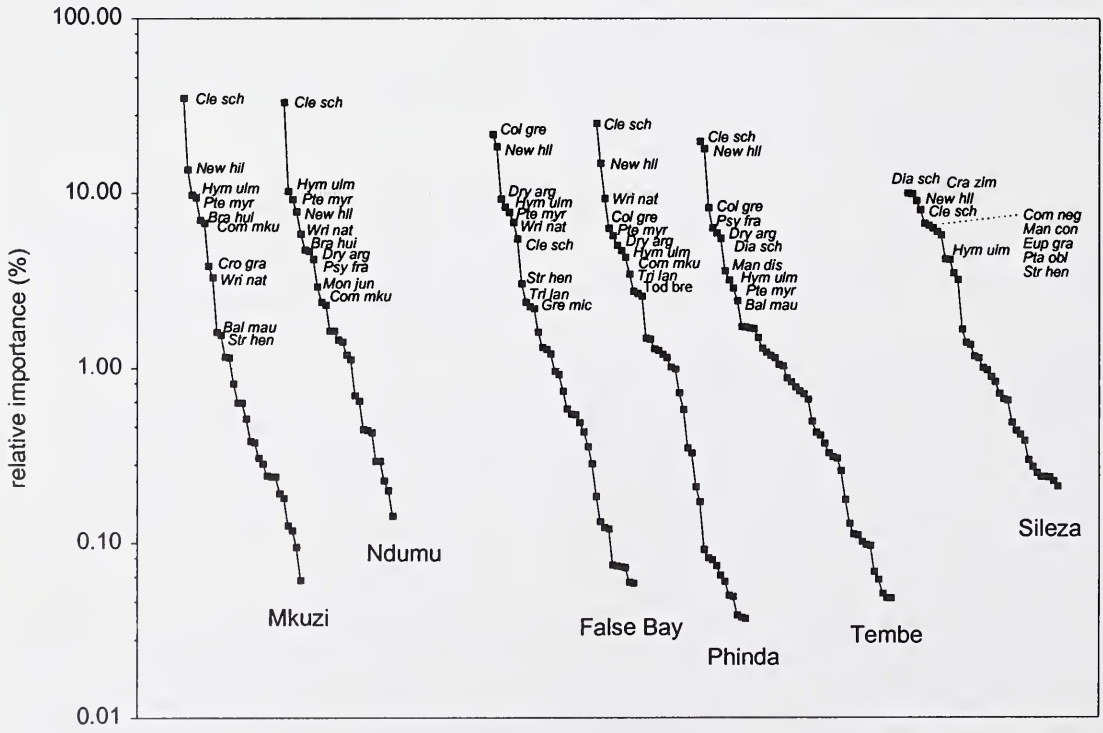


FIGURE 7.—Dominance diversity curves of Sand Forests at sampled sites. Importance values for these curves were calculated as the average of a species' relative dominance (species total DBH/locality total DBH) and its relative density (no. plants/total no. plants) over all quadrats sampled in an area, excluding those shown to be outliers in the DCAs. See Table 1 for full species names.

DISCUSSION AND CONCLUSION

In KwaZulu-Natal, Tropical Dry Forest, including Sand Forest and Ecotonal types, is clearly distinct from both coastal forests and an interior forest. This would tend to support Tinley's (1967, 1977) approach emphasizing the separation of Tropical Dry Forests from all evergreen forests, rather than the more widely accepted approach, grouping Sand Forest and related types with the Coastal Forests (sensu MacDevette *et al.* 1989). Clarification of this issue would require objective comparison of Tropical Dry Forest with a broader range of forests in southern Africa, especially Afromontane types.

In the sampled range of Tropical Dry Forests in KwaZulu-Natal, Sand Forest samples form a natural and cohesive group, with most sites dominated by a similar range of species, primarily *Cleistanthus schlechteri* and *Newtonia hildebrandtii*. Sand Forest is however characterised by the presence of *Cleistanthus schlechteri, Hymenocardia ulmoides, Toddaliopsis bremekampii, Psydrax fragrantissima, Pteleopsis myrtifolia* and *Haplocoelum gallense.*

In the most comprehensive floristic study of KwaZulu-Natal forests to date, MacDevette *et al.* (1989) classify the indigenous forests of KwaZulu-Natal using species lists (of varying reliability) from 105 sites. Tropical Dry Forests, characterised by the presence of *Cleistanthus schlechteri,* are classified as a subtype of the Coastal Forests with *Pteleopsis myrtifolia, Suregada zanzibariensis, Monodora junodii, Salacia leptoclada* and *Croton pseudopulchellus* as preferential species. Tropical Dry Forests are further divided into Western and Eastern Sand Forests. Western Sand Forests include forests in Ndumu Game Reserve, Mkuzi Game Reserve, False Bay Park and the area now included in Phinda Resource Reserve and have *Brachylaena huillense, Boscia foetida, Cadaba natalensis, Newtonia hildebrandtii, Haplocoelum gallense, Wrightia natalensis* and *Strychnos usambarensis* as preferential species. Eastern Sand Forests (Manguzi Forest, Sileza Forest and forests in Tembe Elephant Park and Sodwana State Forest) are said to occur from Cape Vidal northwards with *Canthium setiflorum, Coffea racemosa, Tarenna supra-axillaris* subsp. *barbetonensis, Inhambanella henriquesii, Ephippiocarpa orientalis, Cavacoa aurea* and *Apodytes dimidiata* as preferential species. Their study provides a useful framework for comparison, although discrimination at fine scales is probably poor due to the use of whole forests as individual sample units, with only presence/absence of species noted. We support MacDevette *et al.* (1989) in dividing Sand Forest into convenient Western and Eastern types, although our groups do differ.

The similarity in terms of dominant tree species across the range of Sand Forests indicates that these forests can be treated as functionally uniform. This is important, as it allows us to extrapolate the results of ecological research and apply similar management practices throughout. Significant turnover of plant species does occur however, and since many species appear to be confined to these forests (pers. obs.), conservation of the range of variation is crucial. Fortunately, although Sand Forest covers a smaller area than any other vegetation type in South Africa, it is well conserved (Low & Rebelo 1996). Our survey of woody plants indicates that the full range of variation in South Africa is represented in conserved areas. Forests in Mkuzi and Ndumu Game Reserves represent the Western Sand Forest, while forests in False Bay Park, Phinda Resource Reserve, Tembe Elephant Park and Sileza Forest Reserve adequately represent the more variable Eastern Sand Forest. The non-woody understorey component of these forests deserves further study. Turnover of herbaceous plants and grasses between sites appears to be high and these plants may include a high proportion of endemics. The naturally patchy nature of these forests suggests that the fragmentation associated with conservation in non-contiguous reserves is unlikely to be important.

ACKNOWLEDGEMENTS

This study was made possible by funding from the Foundation for Research and Development, the University of Cape Town and the Gold Fields WWF-SA Environmental Programme. A bursary from the Botanical Society of South Africa helped with living expenses during the study period. Thanks to Phinda Resource Reserve, KwaZulu-Natal Nature Conservation Services and the South African National Defence Force for accommodation and access to forests under their control. Dr P.S. Goodman, Ian Rushworth and Wayne Matthews of KZN-NCS and Rick van Wyk of Forestek helped with species identifications and provided valuable discussion. R. van Wyk, D.R. MacDevette, D. Everard and I. Gordon kindly allowed the use of their unpublished data from a variety of KwaZulu-Natal forests. Finally, Rowena Smuts and Ronnie Brereton-Stiles, amongst others, helped relieve the tedium of data collection.

REFERENCES

BAYER, A.W. 1938. An account of the plant ecology of the Coastbelt and Midlands of Zululand. *Annals of the Natal Museum* 8: 371–460.

BRUTON, M.N. & COOPER, K.H. (eds). 1980. *Studies on the ecology of Maputaland.* Rhodes University Press and the Natal Branch of the Wildlife Society of Southern Africa.

CRAIB, A. 1995. Maputaland. *Africa—Environment & Wildlife* 3, 4: 33–59.

CUNNINGHAM, A.B. 1985. *The resource value of indigenous plants to rural people in a low agricultural potential area.* Ph.D. thesis, University of Cape Town.

DAVIES, O. 1976. The older coastal dunes in Natal and Zululand and their relation to former shorelines. *Annals of the South African Museum* 71: 19–32.

DE MOOR, P.P., POOLEY, E., NEVILLE, G. & BARICHIEVY, J. 1977. The vegetation of Ndumu Game Reserve, Natal: a quantitative physiognomic survey. *Annals of the Natal Museum* 23: 239–272.

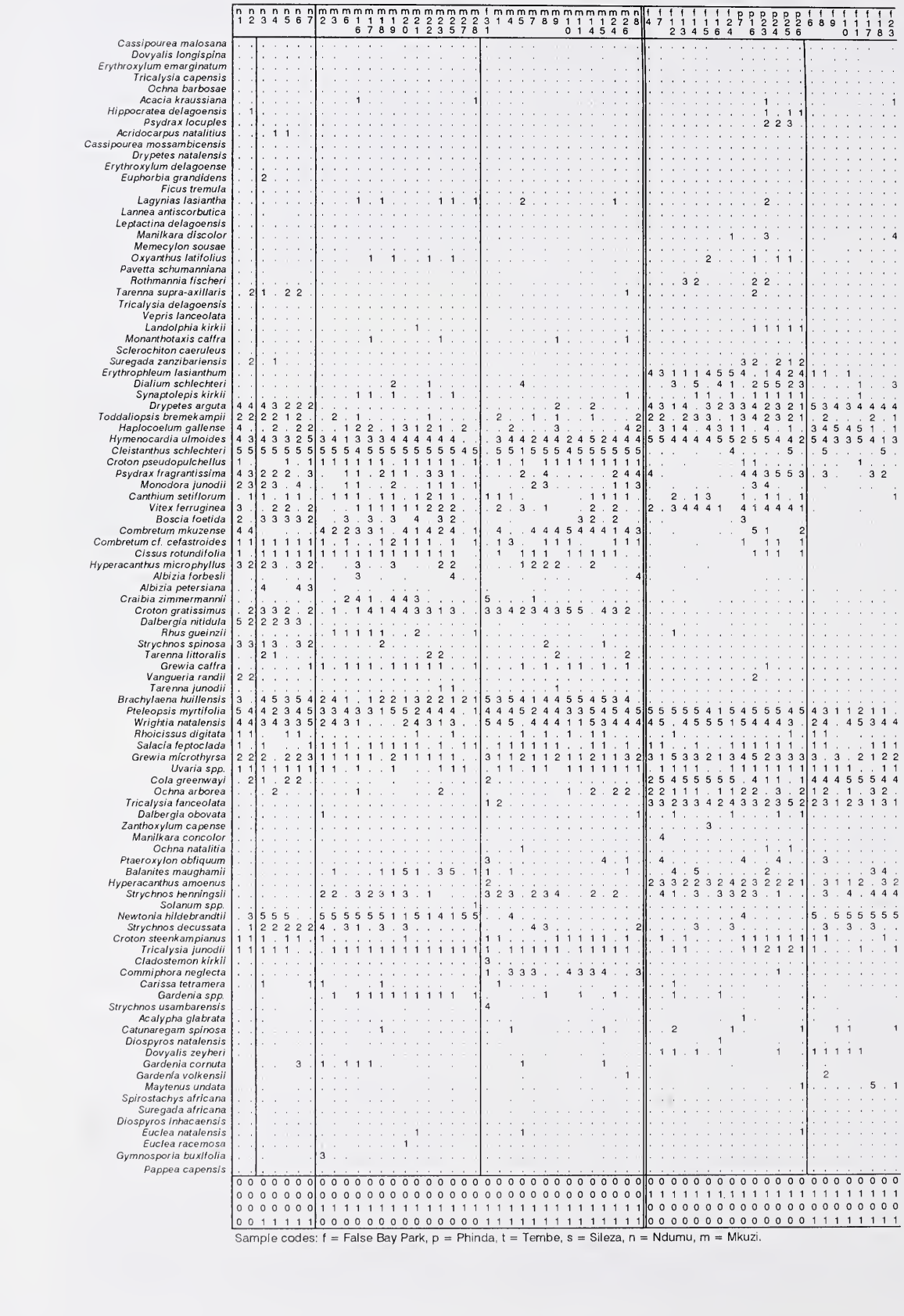
GAUCH, H.G. 1982. *Multivariate analysis in community ecology.* Cambridge University Press, Cambridge.

GELDENHUYS, C.J. & MACDEVETTE, D.R. 1989. Conservation status of coastal and montane evergreen forest. In B.J. Huntley, *Biotic diversity in southern africa: concepts and conservation*: 224–238. Oxford University Press, Cape Town.

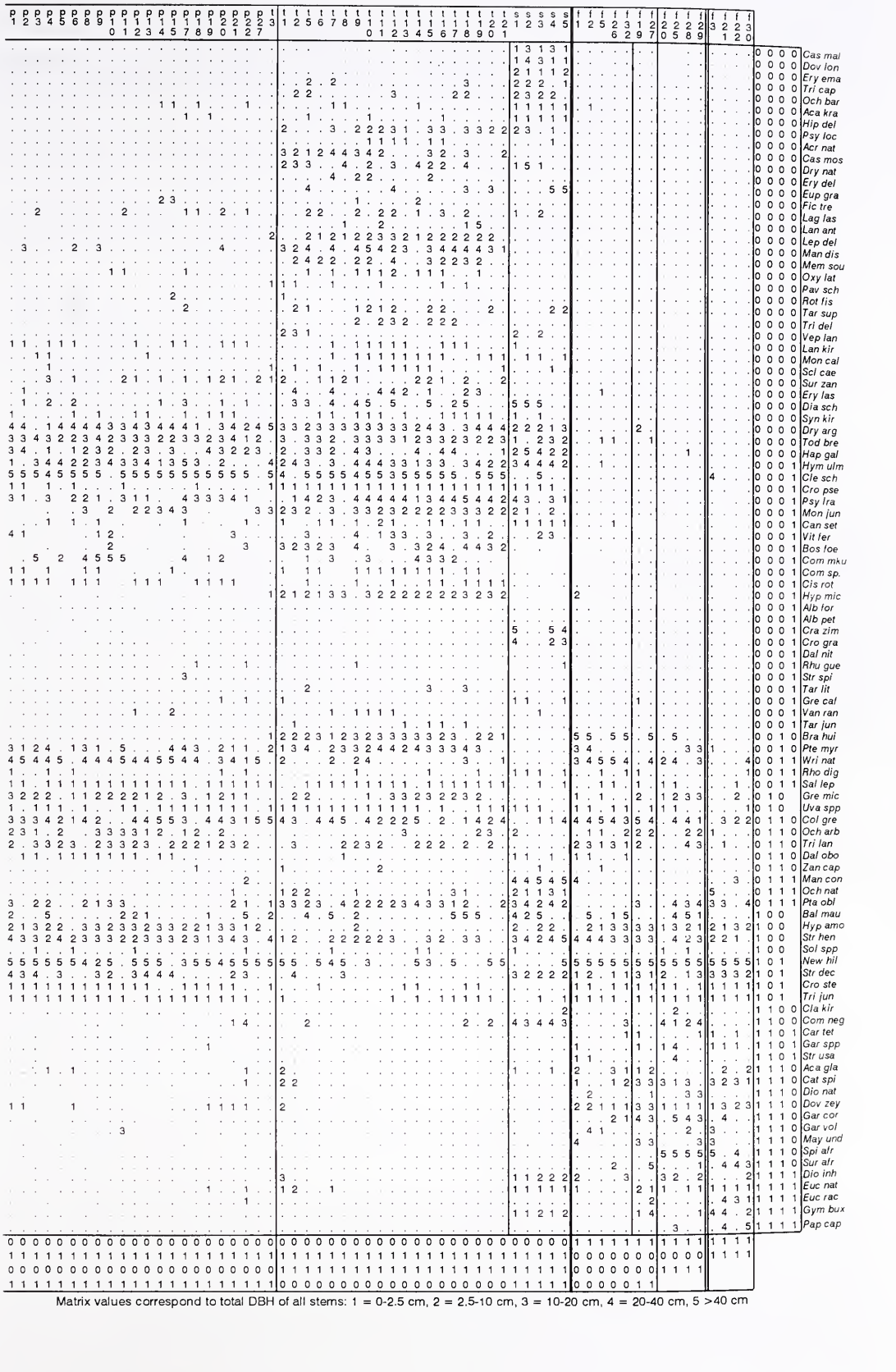
GOODMAN, P.S. 1990. *Soil, vegetation and large herbivore relations in Mkuzi Game Reserve, Natal.* Ph.D. thesis, University of the Witwatersrand, Johannesburg.

HARISSON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. (eds). 1997. *The atlas of southern African birds.* Vol. 2. Passerines. Birdlife South Africa, Johannesburg.

TABLE 1.— Two-way ordered table of Tropical Dry Forest releves in Maputaland, KwaZulu-Natal



Sample codes: f = False Bay Park, p = Phinda, t = Tembe, s = Sileza, n = Ndumu, m = Mkuzi.



Matrix values correspond to total DBH of all stems: 1 = 0-2.5 cm, 2 = 2.5-10 cm, 3 = 10-20 cm, 4 = 20-40 cm, 5 >40 cm

HILL, M.O. 1979. *TWINSPAN—a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of individuals and attributes.* Cornell University, Ithaca, New York.

KENT, M. & COKER, P. 1992. *Vegetation description and analysis: a practical approach.* Belhaven Press, London.

LAWSON, D. 1986. *The ecology and conservation of Suni in Natal.* Ph.D. thesis, University of Natal, Pietermaritzburg.

LOW, A.B. & REBELO, A.G. (eds). 1996. *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.

LUBKE, R.A. & MCKENZIE, B. 1996. Coastal Forest. In A.B. Low & A.G. Rebelo, *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.

MACDEVETTE, D.R., MACDEVETTE, D.K., GORDON, I.G. & BARTHOLOMEW, R.L.C. 1989. Floristics of the Natal indigenous forests. In C.J. Geldenhuys, *Biogeography of the mixed evergreen forests of southern Africa.* Ecosystem Programmes Occasional Report No. 45. Foundation for Research Development, Pretoria.

MACFARLANE, P. 1993. ConsCorp opens a unique lodge. *Travel News Weekly 15 December*: 7.

MAUD, R.R. 1980. The climate and geology of Maputaland. In M.N. Bruton & K.H. Cooper, *Studies on the ecology of Maputaland*: 1–7. Rhodes University Press and the Natal Branch of the Wildlife Society of Southern Africa.

MCKENZIE, B. 1996. Sand Forest. In A.B. Low & A.G. Rebelo, *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.

MIDGLEY, J.J., COWLING, R.M., SEYDACK, A.H.W. & VAN WYK, G.F. 1997. Forest. In R.M. Cowling, D.M. Richardson & S.M. Pierce, *Vegetation of southern Africa*: 278–299. Cambridge University Press, Cambridge.

MOLL, E.J. 1968. Some notes on the vegetation of Mkuzi Game Reserve, Natal. *Lammergeyer* 8: 25–30.

MOLL, E.J. 1978. The vegetation of Maputaland—a preliminary report of the plant communities and their present and future conservation status. *Trees in South Africa* 29: 31–58.

MOLL, E.J. 1980. Terrestrial plant ecology. In M.N. Bruton & K.H. Cooper, *Studies on the ecology of Maputaland*: 52–68. Rhodes University Press and the Natal Branch of the Wildlife Society of Southern Africa.

MOLL, E.J. & WHITE, F. 1978. The Indian Ocean coastal belt. In M.J.A. Werger, *Biogeography and ecology of southern Africa*: 562–598. Junk, The Hague.

POOLEY, E. 1993. *The complete field guide to trees of Natal, Zululand and Transkei.* Natal Flora Publications Trust, Durban.

TER BRAAK, C.J.F. 1991. *CANOCO—a FORTRAN program for canonical community ordination by (partial) (detrended) (canonical) correspondence analysis (Version 3.12).* Agricultural Mathematics Group DLO, Wageningen.

TINLEY, K.L. 1967. The moist evergreen forest—tropical dry semi-deciduous forest tension zone in north-eastern Zululand and hypotheses on past temperate/montane rain forest connections. In E.M. van Zinderen Bakker, *Paleoecology of Africa* 2: 82–85.

TINLEY, K.L. 1977. *Framework of the Gorongosa ecosystem, Moçambique.* D.Sc. thesis, University of Pretoria, Pretoria.

VAHRMEIJER, J. 1966. Notes on the vegetation of northern Zululand. *African Wildlife* 20: 151–161.

VAN WYK, B. & VAN WYK, P. 1997. *Field guide to the trees of southern Africa.* Struik, Cape Town.

WARD, M.C. 1981. *A preliminary investigation into the ecology of Sand Forest, Maputaland.* B.Sc. (Hons.) thesis, University of Natal, Durban.

WATKEYS, M.K., MASON, T.R. & GOODMAN, P.S. 1993. The role of geology in the development of Maputaland, South Africa. *Journal of African Earth Sciences* 16: 205–221.

WHITE, F. 1983. *The vegetation of Africa.* A descriptive memoir to accompany the Unesco/AETFAT/UNSO vegetation map of Africa. Unesco, Paris.

Bothalia 29,2: 305–325 (1999)

Ordination and classification of vegetation of Songimvelo Game Reserve in the Barberton Mountainland, South Africa for the assessment of wildlife habitat distribution and quality

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Keywords: Barberton Mountainland, CANOCO, classification, habitat suitability, ordination, PATN, South Africa, vegetation sampling

ABSTRACT

A vegetation survey was undertaken of the 49 000 ha Songimvelo Game Reserve in the Barberton Mountainland of Mpumalanga, South Africa with the aim to identify constituent plant communities and to assess their relative value to wild herbivores. The vegetation is highly diverse with representation of three biomes; Savanna, Grassland and Forest. A total of 428 plots were sampled by means of a semi-quantitative technique. Data were subjected to ordination (CANOCO) and classification (PATN). The composition of the 19 distinct communities is determined through an intricate combination of environmental factors as evident from the ordination results. Firstly 'drainage line' position is critical, followed by land use history and further by the interplay between elevation and geology. These findings are in line with results obtained from other studies along the eastern Escarpment. Alluvium, mafic and ultramafic lavas support mixed veld, whereas felsic lavas, sandstones and quartzites support sour veld which has a very low forage value in the dry season. Each community, through its specific species assemblage, structure and location, forms a distinctly different habitat in terms of its value to the various species of herbivores in the SGR.

INTRODUCTION

The 49 000 ha Songimvelo Game Reserve (SGR) is located within an area of great conservation and biogeographic value (Fourie *et al.* 1988; Matthews *et al.* 1993), of internationally renowned geological interest (Lowe & Byerly 1999) and with aesthetically striking landscape attributes (Anon. 1986). The vegetation is highly diverse with representation of three biomes; Savanna, Grassland and Forest.

These conservation and scientific values are of limited consequence to the impoverished rural communities living alongside the Reserve. Tangible economic benefits through tourism are essential to obtain local community acceptance and support for the use of the land for conservation. Successful ecotourism development in this area depends largely on the introduction and maintenance of a large wild herbivore component (Anon. 1998).

A description of the vegetation and an understanding of the underlying causal factors are required in order to assess habitat suitability for wild herbivores and in order to formulate appropriate management guidelines. Prior to the present study, no comprehensive vegetation survey had been undertaken of this area and consequently little information was available on the vegetation-herbivore interrelationships.

Vegetation composition has direct bearing on the quality and seasonality of available feed (Barnes *et al.* 1984; Eckhardt *et al.* 1993; Fabricius & Mentis 1990). Vegetation structure (height and density) largely controls its availability to herbivores (Fabricius & Mentis 1992).

The aims of this study were firstly to classify the vegetation of the SGR into identifiable plant communities based on composition and structure, secondly to identify the main environmental factors responsible for this vegetation pattern, and lastly to assess the relative value of the identified plant communities to the wild herbivores.

STUDY AREA

The SGR is located in the southeastern part of Mpumalanga on the South African-Swaziland border at latitude 25° 45'–26° 5' S and longitude 30° 46'–31° 16' E (Figure 1).

Geology, soils, topography and drainage

The SGR is situated in the Barberton Mountainland which forms part of the African erosion surface (Partridge & Maud 1987). Elevation ranges from 600 to 1 900 m above sea level. The SGR is drained by numerous perennial rivers and streams of which the Komati is the most important. The Komati Valley represents some 10 000 ha of relatively gentle topography, whereas the remainder of the Reserve is more rugged.

The Barberton Mountainland represents an early Precambrian greenstone belt (Viljoen & Viljoen 1971). The entire succession of supracrustal rocks constituting the greenstone belt is known as the Swaziland Sequence and has been divided into three groups. The Onverwacht Group represents the initial volcanic phase of the belt. For purposes of the study, this group was divided in two units. The Tjakastad unit combines the Komati and Theespruit formations consisting of basaltic and peridotitic komatiite

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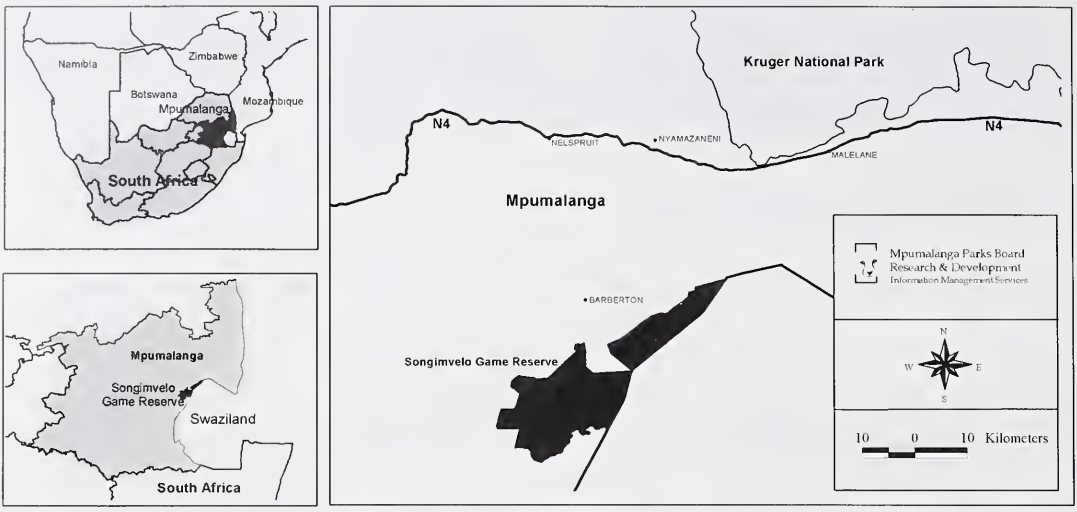


FIGURE 1.—Location of the study area in Mpumalanga, South Africa (information source Mpumalanga Parks Board).

and tholeite with various mafic and ultramafic schists. Alluvial deposits in the lower Komati Valley were lumped with this group. The Geluk unit combines the Zwartkoppie, Kromberg and Hooggenoeg formations and includes mostly mafic and felsic volcanic rocks, agglomerates, breccia, chert and shales. The Onverwacht Group is overlain by an argillaceous group (Figtree) and an arenaceous group (Moodies). These include sandstones, quartzites, shales, agglomerate and conglomerate. Acid igneous intrusives occur in the form of biotite trondhjemite gneisses in the southwestern corner and granodiorite-adamellite along the southern edge of the SGR.

Geology and elevation are not independent of each other. The different groups stretch in a wedge shape, from the broad low-lying Komati Valley in the southwest to the narrow band of mountains in the northeast. Ultramafic and mafic substrates generally occur at lower elevation, whereas felsic lavas, quartzites and sandstones are found at higher elevations. Average elevation increases from 919 m for the Tjakastad unit, 1 098 m for Geluk to 1 219 m for Figtree and Moodies. A corresponding increase in average annual rainfall contributes to more leached and acid soils derived from the Geluk and Figtree units with lowest pH values of 4.4 as compared to the highest pH value of 7.1 in the lower Komati Valley (Anon. 1986).

Climate

Rainfall, which is concentrated between November and March, varies from less than 800 mm per year in the low-lying southwestern area to over 1 600 mm in the high-lying northeastern parts (Gamble 1988). Mean minimum and maximum monthly temperatures are 5.4°C and 7.9°C in July and 22°C and 34°C in January for the highland and lowland areas respectively (Anon. 1986). Frost is common during winter months in the Komati Valley.

Archaeology and land use history

The SGR is characterised by a long and diverse history of land use. Witt (1983) reports middle Stone Age artefacts dating back 30 000 to 50 000 years. Stone-walled sites of the Later Iron Age (the last 1 000 years) are common (Anon. 1986). The SGR area was settled by the bakaNgwane (people of Swaziland) during the reign of King Mswati II (1840–1868) (Van der Merwe & Retief 1995). During the last 100 years gold and asbestos mining took place. The area was used for winter grazing of sheep from the turn of the century. In 1985, some 350 households were living within the future SGR. The total area under dryland cultivation was ± 850 ha. Since then the number of residents has declined with only 40 families remaining in 1997. By 1985, only limited numbers of small game still occurred. Since 1986 a total of 20 species of large herbivores totalling more than 2 000 animals have been re-introduced.

Vegetation

The vegetation of the higher-lying regions of the SGR belongs to the Grassland Biome. The lower-lying Komati Valley falls within the Savanna Biome (Rutherford & Westfall 1986). Three of Acocks's (1975) veld types occur. Veld types 8 (North-eastern Mountain Sourveld) and 63 (Pict Retief Sourveld) correspond to the North-eastern Mountain Grassland of the Grassland Biome as defined by Low & Rebelo (1996). Veld type 9 (Lowveld Sour Bushveld) corresponds to the Sour Lowveld Bushveld of the Savanna Biome. The Forest Biome is represented by numerous isolated patches of forest, mostly at higher elevation and along drainage lines.

METHODS

Sampling approach

Edwards' (1983) structural classes were used to describe the overall structural properties of the sampled plots. Overall cover was estimated for the woody, grass, forb and geophyte component respectively, using the semi-quantitative measures of the Braun-Blanquet

approach (Mueller-Dombois & Ellenberg 1974). Cover and height classes were recorded for individual woody and grass species. Individual geophytes and forbs were omitted from the list of species for three reasons. Firstly, grasses and woody species are of most importance to the herbivores. Secondly, the great diversity of forbs would have significantly increased sampling time and would therefore have decreased the possible number of sample plots. Thirdly, because of logistical constraints, sampling was spread across seasons which would have resulted in a differential presence of geophytes depending on the sampling date. Records of environmental data included elevation, by means of an altimeter (± 20 m) and the 1:50 000 topocadastral maps; geology, according to 1:250 000 geological survey maps (Geological Survey 1986); and locally at a finer scale through personal observations; landscape position (Land Type Survey Staff 1989), aspect (whether predominantly N, E, S or W), slope steepness (class estimate), soil texture (using the sausage method (National Working Group for Vegetation Ecology 1986)) and rockiness (estimated as a percentage of the ground cover).

It was deemed important to achieve a high number and sufficient spread of sampling plots for two reasons. Firstly, Austin & Heyligers (1989) argue that where there is no existing information on vegetation (as was largely the case in this instance), surveys should sample various combinations of environmental variables as a means of obtaining a representative sample. Secondly, they contend that sampling the full range of environments ensures that predictive models derived from survey data can be used for interpolation rather than extrapolation. Furthermore, in resource surveys in which a major objective is the detection of as much diversity as possible, randomisation is largely irrelevant (Gillison & Brewer 1985). In this instance the authors were not concerned with a statistical estimation of the proportions of the survey area covered by different vegetation communities. Provided there has been sufficient ground coverage to ensure correct interpretation, these areas can be measured, for example, from aerial photographs or satellite imagery with sufficient accuracy.

Different combinations of environmental variables and different vegetation communities were sampled in 428 plots of 30 × 30 m which were subjectively located. Although the whole Reserve was covered, samples tend to be clustered as dictated by terrain accessibility (Figure 2). The question with regard to this approach is whether it adequately captures the floristic diversity and the large range of abiotic conditions which might determine community composition. This was investigated in two ways. Firstly, the coverage by sample plots of different combinations of environmental factors was determined. The combinations of environmental factors such as elevation and geology were obtained through the use of the IDRISI Geographic Information System (Eastman 1992). The geographic position of the samples was determined in the field by means of a Global Positioning System (GPS) and incorporated into the GIS. Secondly, the adequacy in capturing the floristic diversity was assessed by direct comparison of the sample data with the known woody and grass diversity of the SGR.

Ordination

The CANOCO computer package (Ter Braak 1992) was selected to analyse relationships between the data set of 428 plots by 346 species and the underlying environmental factors. CANOCO allows for canonical ordination which is an intermediate technique which combines aspects of regular ordination with aspects of regression (Jongman *et al.* 1987). The resulting ordination diagram expresses not only the pattern of variation in species composition but also the main features of species distributions along the gradient of environmental variables (Ter Braak 1986). A step-wise approach was followed in which groups of plots, determined by specific environmental conditions identified in the previous ordination run, were removed from the remaining data set for the next ordination. Both Principal Components Analysis (and its canonical equivalent Redundancy Analysis—henceforth RDA) and Correspondence Analysis (and its canonical equivalent Canonical Correspondence Analysis—henceforth CCA) were used, based on the type of response model exhibited by the local species. As a practical guideline, Ter Braak & Prentice (1988) sug-

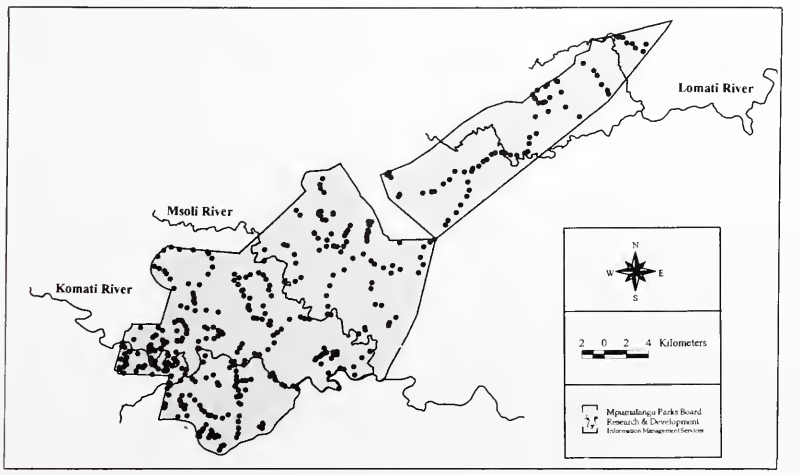


FIGURE 2.—Distribution of 428 semi-quantitative sample plots (depicted as ●) across the Songimvelo Game Reserve.

gested that most species are behaving monotonically if the gradient length is less than 1.5 sd [standard deviation or unit of ordination-length as defined by Hill & Gauch (1980)]. Gradients longer than 3 sd can be analysed using CA and related techniques. The range 1.5–3 sd for the first axis represents a 'window' over which both PCA/RDA and CA/DCA/CCA can be used to good effect. In practice, the data set was subjected to a DECORANA run (Hill 1979a) which led to the identification of a gradient length of 5.347 sd along the first axis.

Classification

Classification or cluster analysis was used to identify groups and to impose structure on the raw data (Jongman *et al.* 1987). The PATN software package (Belbin 1988) was used. PATN incorporates a host of classification techniques including TWINSPAN (Hill 1979b). In particular, the ALOC module was used.

ALOC stands for 'allocation' and implements a simple non-hierarchical clustering strategy. In a first phase the first sample plot in the data set is used as a 'seed' to create a starting configuration that ALOC can iterate on. Each object in the data set is compared to each seed. If the resulting association is greater than an allocation radius between zero and one, the object itself becomes a seed and the number of groups increases with one. The process continues until all objects have been compared with all seeds. The second phase begins with object 1 and sequentially allocates each object to the nearest seed as generated in the first phase. The third phase dismisses the seeds and calculates the group centroids based on the objects which were assigned to each group in phase 2. The fourth phase is iteration and re-location. Each iteration sequentially extracts each object from the group it currently belongs to and allocates it to the group with the nearest centroid. Groups may disintegrate down to a single object, by the process of re-allocating them to other groups.

The PATN outcome was evaluated subjectively by testing the obtained entities against photographs of each sample plot and field knowledge. The criteria used were the homogeneity of the units and their identifiability in the field.

RESULTS AND DISCUSSION

Sampling adequacy

Landscape diversity

Based on initial field observations and a study in a similar environment (Deall & Theron 1990), elevation and geology were identified as being of major importance. Using six elevation classes, starting at 600 m asl and each spanning 200 m, and the 12 geological substrates, a total of 51 elevation-geology combinations are present in the SGR. Marked differences could be observed in the field across a 200 m elevation difference, in particular when comparing different aspects. Thirteen elevation-geology combinations were not sampled. However, these 13 combinations cover only 1.9% of the SGR with the largest combination standing at only 0.4% of the total surface area. Another seven combinations representing 1.2% of the surface area, only have one sample plot each. Thus, only 3.1% of the surface area in terms of elevation-geology combinations was not sampled at all or was sampled without replication. Sixteen combinations covering 75.4% of the Reserve are represented by more than 10 sample plots per combination. The 428 plots are thus considered to be adequately spread across the SGR.

Floristic diversity

A total of 348 species was recorded for the 428 plots; 247 woody and 101 grass species. A total of 288 woody species is known for the SGR based on independent surveys and ongoing collecting by several taxonomists. The sampled species thus represent 85.8% of this total. Species which were not encountered include *inter alia* *Calodendrum capense, Encephalartos paucidentatus, Kiggelaria africana, Nuxia floribunda, Piper capense, Rhoicissus digitata, Rhus discolor, R. gerrardii, Scutia myrtina, Syzygium guinense* and *Warburgia salutaris*. They are mostly found in forests which cover less than 10% of the Reserve and where they do not constitute a dominant component. The known number of grasses based on ongoing collecting and previous research projects is 136 species (after lumping both in the total list and in the sample plots the subspecies of *Aristida congesta*, *Bothriochloa* spp., *Cymbopogon* spp., *Festuca* spp. and the different varieties of *Setaria sphacelata* as a single species each). It was necessary to lump some of these species and subspecies as sampling conditions covered a wide range of conditions in terms of the length and age of the sward making identification problematic in instances where heavy grazing was experienced or where a fire had recently occurred. The sampled species represent 74.3% of the known total. Species which were not encountered during the sampling are mostly *Eragrostis* spp., *Sporobolus* spp. and *Digitaria* spp., none of which were important in the field.

Ordination results

The first CCA ordination led to a dense cloud of plots representing the major part of the sample, with plots along drainage lines falling outside of this cloud. Eigenvalues of the first and second axes are respectively 0.57 and 0.56.

Plots in 'drainage' positions are covered by forests and thickets, as well as more open wetland or riverine vegetation (Figure 3). Drainage positions have a higher moisture availability and are sheltered from fires. Thickets, which are more prominent at low elevation and on northerly aspects are characterised by species such as *Grewia occidentalis*, *Olea europaea* subsp. *africana* and *Ruttya ovata*. In contrast, forests are much more mesic, occurring at higher elevation and on more southerly aspects, and are characterised by species such as *Combretum kraussii*, *Halleria lucida*, *Keetia gueinzii* and *Schefflera umbellifera*. The wetland and forest communities which these plots represent are clearly defined

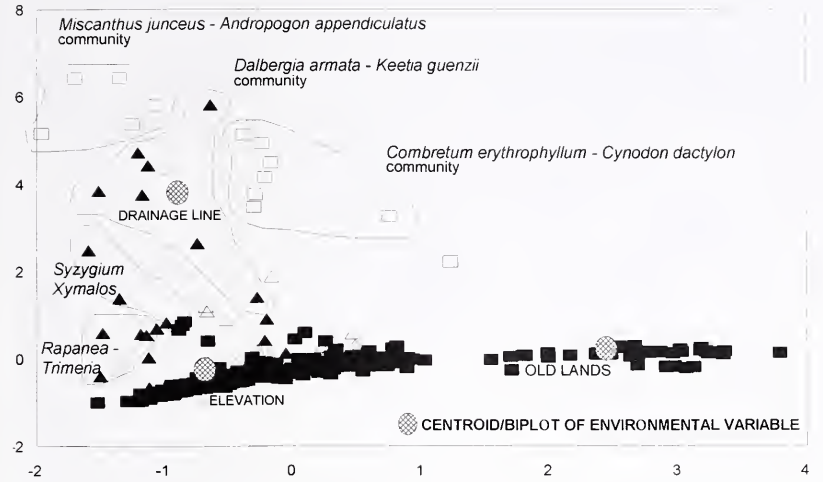


FIGURE 3.—Ordination diagram of the CCA of 428 plots with elevation, drainage position and land use as environmental variables. Forests, ▲; Thicket, Δ; Riverine/wetland, ❑; others, ■.

within the ordination diagram (Figure 3) (see 'Classification' results for an explanation of the community names used).

The 60 forest/thicket/riverine/wetland plots identified through the first CCA were removed from the original data set. The remaining 368 plots were again subjected to CCA ordination. Eigenvalues of the first and second axes are 0.71 and 0.41 respectively. A dense cloud of 'undisturbed' samples spread along an elevation gradient was plotted against a group of samples on old lands and old settlement sites (Figure 4). Within the ordination diagram a clear spatial definition is obvious between the plant communities on old lands at higher elevation (*Lippia javanica–Hyparrhenia* spp. Community) as compared to the lower elevation old lands which are covered by the *Cynodon dactylon–Melinis repens* Community.

The 65 old land and settlement sites identified in the second CCA were subjected to a separate RDA ordination. Resulting eigenvalues were very low at 0.07 and 0.05 for the first two axes respectively. Old lands and old settlements are not so much different in terms of composition as they are structurally distinct. Both sets of plots share species such as *Acacia nilotica, Cynodon dactylon* and *Heteropogon contortus*. *A. nilotica* occurs as scattered low shrubs on old lands but as dense mature thickets on settlement sites. The greater woody cover on old settlement sites probably reflects a longer time span from abandonment and/or the result of better fire protection afforded by old walls. Other typical species are *Hippobromus pauciflorus* and *Pappea capensis*.

After removal of the 65 old land and settlement sites, the remaining 303 plots were again subjected to a CCA ordination. The eigenvalues were relatively high; 0.58 for the first axis and 0.36 for the second axis. Both elevation and geological substratum are clearly important factors but their respective influence could not immediately be ascertained.

Their relative importance was evaluated by ordinating a subset formed by all the plots falling between 900–1 100 m and 1 500–1 700 m in the Geluk and Figtree/Moodies units. The choice of these two elevation belts and substrata was made subjectively in order to obtain enough samples (respectively 33, 19, 13 and 14 plots) while having a large enough difference in elevation (400 m minimum) to ensure the likelihood of elevation-induced vegetation differences.

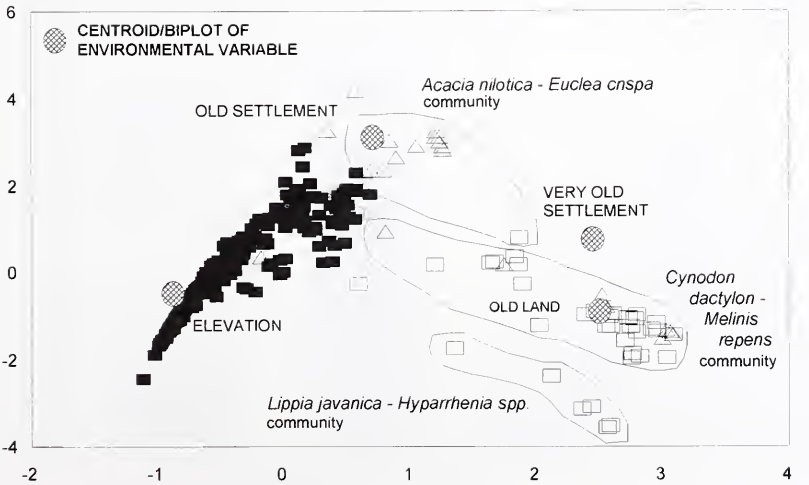


FIGURE 4.—Ordination diagram of the CCA with elevation and land use history as environmental variables of 368 plots remaining after removal of forest and thicket plots. Old settlement, Δ; old lands, ❑, others, ■.

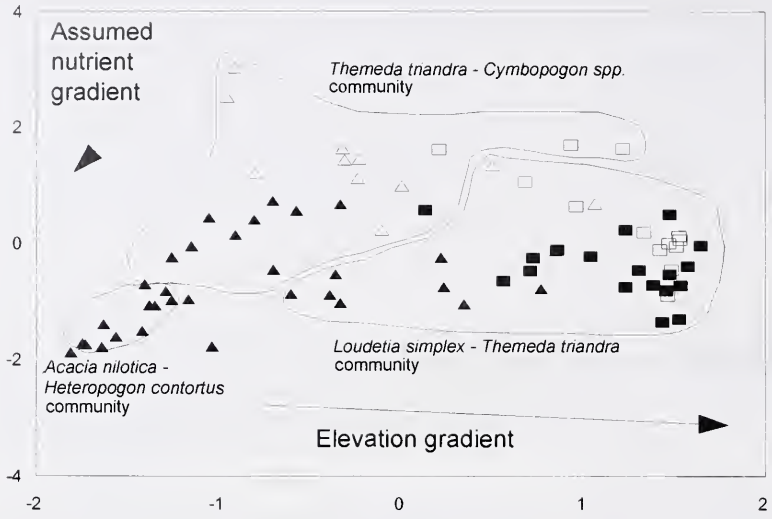


FIGURE 5.—CCA of 4 groups of samples representing combinations of two geological substrates and two elevation belts. Note the separation in ordination space between elevation/geology combinations. 900–1 100 m on mafic/felsic lava, ▲; 1 500–1 700 m on mafic/felsic lava, ■; 900–1 100 m on sandstone/quartzite, △; 1 500–1 700 m on sandstone/quartzite, ❑.

The resulting diagram clearly shows a split between low and high elevation plots within each geological unit and a split between geological units within each elevation belt (Figure 5). The CCA ordination yielded eigenvalues of 0.47 and 0.26 for the first two axes. High t-values and inter-set correlations of -0.84 and 0.63 for elevation on the first and geology on the second axis indicate the importance of these two factors. A total of 74.7% of these sample plots are classified into three communities which are spatially distinctly defined in the ordination diagram.

Based on the above, the subsets formed by the three major geological units were ordinated separately. The 45 plots occurring on alluvium and the Tjakastad subgroup were ordinated using CCA. The eigenvalues for the first axis was 0.45 and for the second 0.27. They generally represent the lowest-lying area of the Reserve as well as the least broken part. Elevation is an important factor, but landscape position is also critical. The plains and footslopes are characterised by grass species such as *Aristida congesta*, *Eragrostis chloromelas* and *Heteropogon contortus* and woody species such as *Acacia caffra*, *A. nilotica* and *Combretum hereroense*. Upper slopes are typically covered by *Combretum apiculatum* while with elevation an increase in the more sour grass species such as *Loudetia simplex*, *Panicum natalense*, *Trachypogon spicatus* and *Tristachya leucothrix* is apparent.

The CCA ordination diagram for the 153 plots on the Geluk subgroup again yielded elevation as being the most important environmental factor. The eigenvalue for the first axis was 0.49 and 0.21 for the second. At high elevation, *Erica drakensbergensis*, *Koeleria capensis* and *Protea roupelliae* are found. Warmer, northerly aspects are often characterised by *Combretum apiculatum, Gymnosporia buxifolia* and *Pterocarpus angolensis*. On cooler and moister southerly aspects sour species such as *Alloteropsis semialata* subsp. *eckloniana* are prominent. *Aristida canescens/transvaalensis* and *Xerophyta* spp. are associated with steep westerly and northerly slopes.

Elevation was also the most important factor according to the CCA ordination diagram for the 81 plots on Figtree and Moodies substrata. Eigenvalues were 0.34 and 0.24 for the first two axes respectively. *Alloteropsis semialata* subsp. *eckloniana*, *Koeleria capensis*, *Protea caffra* and *Rendlia altera* are representative of a large proportion of the vegetation.

Classification results

The ALOC classification results are presented by means of a dendrogram. The y-axis represents decreasing association (or increasing 'distance') between groups of sample plots. A total of 24 classification groups were produced (Figure 6).

The three main splits represent respectively, mixed, 'forest/thicket' and sour communities. Sour refers to vegetation of which the forage quality declines sharply towards the dry and cold winter making it less acceptable to herbivores. Mixed communities are intermediate between sour and sweet communities. The latter retain their forage quality during the dry season (Ellery *et al.* 1995).

Based on the frequency distribution of the cover classes, each main split exhibits a particular combination of woody, grass and forb cover (Figure 7). Mixed communities are generally more wooded and have a less dense grass layer. Forests and thickets have per definition a closed to virtually closed woody layer and a low grass cover. The sour communities are less wooded and have a very dense grass layer. These three main splits reflect the major physiognomic characteristics of the three biomes that occur in the Reserve, namely Savanna, Forest and Grassland (Rutherford & Westfall 1986).

Grass species were classified in terms of their palatability, particularly late into the growth season and into the dry season (Ellery *et al.* 1995; Van Oudtshoorn 1991). Based on the frequency distribution across different cover classes, a cover value was approximated for each species in the mixed and sour communities. The unpalatable or sour species make up more than 60% of total cover in the sour split, whereas the palatable sweet

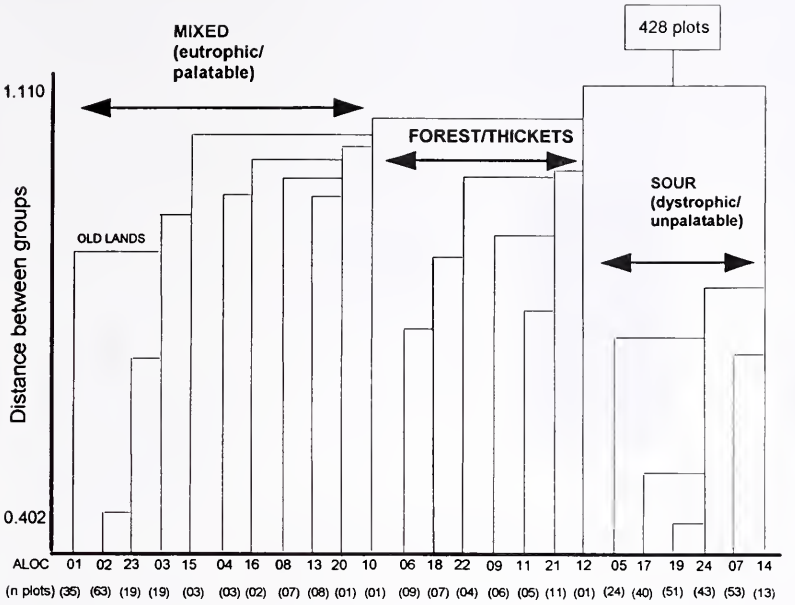


FIGURE 6.—Dendrogram of the ALOC classification of 428 sample plots.

grasses contribute less than 10% (Figure 8). This neatly fits the definition for sour grasslands derived by Ellery *et al.* (1995). The mixed split similarly fits the definition by being intermediate between the sour and sweet grassland with the latter having more than 20% sweet grasses and a cover of less than 30% by sour grasses.

These sour communities occur at elevations above 1 000 m where the high rainfall results in leached soils on mostly Geluk, Figtree and granitic substrates which are dystrophic (Anon. 1986). Within the sour split, groups 5, 17, 19 and 24 represent the typical sour grasslands. Groups 7 and 14 represent mixed communities with a higher cover of woody species.

Below this first split, the next branch defines the mixed communities and the forests and thickets. Classification groups 6, 18, 22, 9, 11 and 21 make up the forests and thickets. The mixed communities occur generally at lower elevation and are more wooded and are generally situated on nutrient rich alluvium and Tjakastad geology.

Within the mixed split, the riverine and wetland communities (groups 4, 16, 8, 13, 20 and 10) are isolated. The remainder of the mixed split comprises the drier communities with *Acacia nilotica* as a visually striking element (groups 1, 2, 23, 3 and 15). The further division (group 1) comprises old lands.

Description of plant communities

Of the 24 classification groups, it is difficult to differentiate in the field between groups 2 and 23, groups 4 and 16, groups 17, 19 and 24, as well as groups 7 and 14. After lumping these groups, 19 units or communities remain. The community concept is applied in its broad sense and reflects a recurring assemblage of grass and woody species of characteristic composition and struc-

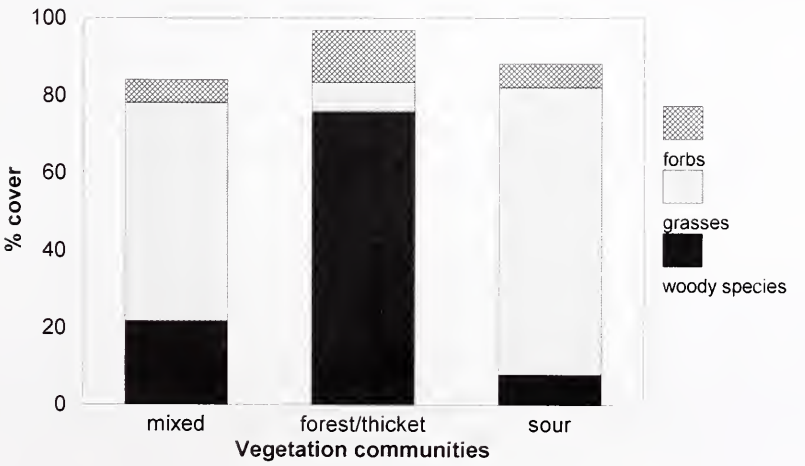


FIGURE 7.—Main ALOC groups; summarised woody, grass and forb cover values based on frequency distribution of sample plots across cover classes.

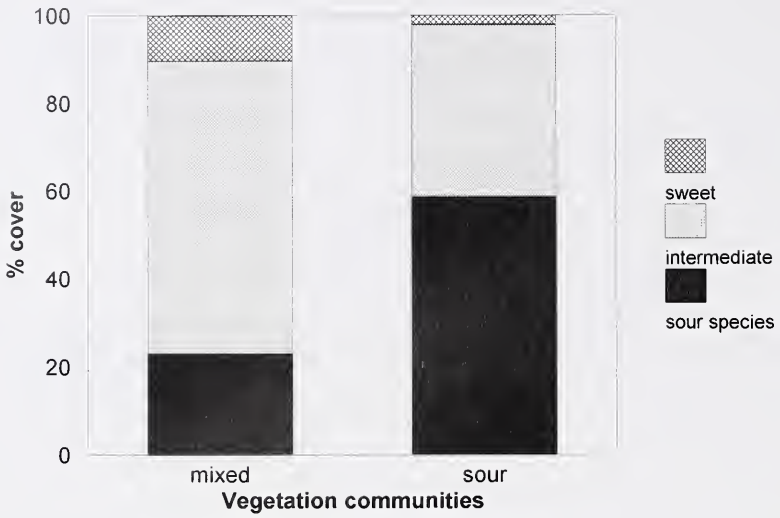


FIGURE 8.—Relative contribution of palatable, intermediate and unpalatable grass species to the mixed and sour split in the ALOC dendrogram.

ture, growing in an area of essentially similar environmental conditions and land use history (adapted from Gabriel & Talbot (1984)). These communities occur both on a micro- (1 m^2 to 10^6 m^2) and meso-scale (10^6 m^2 to 10^{10} m^2) (Delcourt & Delcourt 1988). Community names were chosen subjectively so as to have practical value in the field through the use of two species which are visually and/or diagnostically important. Structural information with regard to vegetation height and openness follows Edwards (1983). A synoptic table with constancy values for all species in the 19 plant communities is provided (Appendix).

1. *Cynodon dactylon–Melinis repens* Short Shrubland (classification group 1, n = 35 sample plots)

This community is mostly found in the lower-lying Komati Valley below 1 000 m. It occupies footslopes and river terraces which have been cultivated or settled in the past. Soils are clayey. More than half of the sample plots had a woody cover of less than 5%. The most frequently occurring shrub is *Acacia nilotica* (Table 1). A further 31 woody species were recorded, typically including *Dichrostachys cinerea*, *Euclea crispa*, *Rhus pentheri*, *Sclerocarya birrea*, and *Ziziphus mucronata*. The grass component is generally less than 0.5 m tall with a characteristic combination of two or more of the following species: *Bothriochloa* spp., *Cynodon dactylon* and *Heteropogon contortus* (Table 1). In total 41 species of grasses was recorded. More than half of the sample plots were subject to moderate or heavy grazing pressure. The forb component as observed in the field comprises alien species such as *Conyza* spp., *Acanthospermum australe* and *Schkuhria pinnata*.

2. *Acacia nilotica–Heteropogon contortus* Low Woodland (classification group 2 & 23, n = 82)

This community also occurs in the low-lying Komati Valley (Figure 9). It forms the broad matrix within which patches of the first (*Cynodon dactylon–Melinis repens*) and third community (*Acacia nilotica–Euclea crispa* Community) are embedded. This community itself has been exposed for a long time to wood extraction and heavy grazing by livestock, but its soil surface has not been directly modified. This is probably because of the often extremely rocky character of the habitat. Only 5 out of 82 sample plots occupy sites of old lands or settlement.

The woody component is generally open to closed. A total of 74 woody species was recorded with *Acacia nilotica* as the most frequently occurring tree in association with *Euclea crispa* shrubs (Table 1). The dominant species in the grass layer is *Heteropogon contortus*. A total of 55 grass species was encountered.

3. *Acacia nilotica–Euclea crispa* Low Woodland (classification group 3, n = 19)

This community has many species in common with the previous one, but is generally a closed formation occurring as discrete patches on mostly old settlement sites, but also on dolerite dykes. These sites are mostly situated in the Komati Valley. *Acacia nilotica* is the dominant woody element, often forming a closed, even-aged canopy. Of particular importance is the occurrence of valuable browse species such as *Berchemia zeyheri*. In total, 61 woody species was observed. Only 29 grass species were recorded of which *Heteropogon contortus* was dominant. *Cynodon* is also important. The forb component as observed in the field harbours the alien *Zinnia peruviana*. *Ornithogalum saundersiae* is a conspicuous geophyte which is found along old settlement walls of packed rock.

4. *Combretum apiculatum–Xerophyta retinervis* Low Woodland (classification group 15, n = 3)

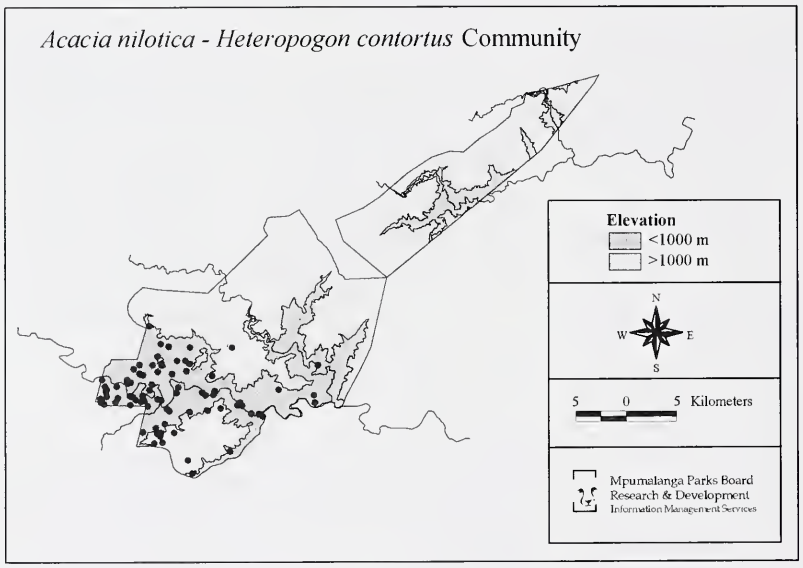
This community is confined to moderately steep to very steep rocky upper slopes overlooking the Komati River on an ultramafic substrate. It is physiognomically very distinct with the tall fibrous perennial *Xerophyta retinervis* under a canopy of *Combretum apiculatum*. The

TABLE 1.—Synoptic table with constancy values for selected common and diagnostic species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each). Symbols refer to the following constancy ranges: * 1–25%, ** 26–50%, *** 51–75%, **** 76–100%

	'mixed' split in ALOC dendrogram									thicket/forest split							'sour' split		
	mixed			old land		wetland/ river		alien		thicket			forest				sour grassland		
Community number ➡	2	3	4	1	7	5	6	8	9	13	14	15	16	10	11	12	17	18	19
Group A: sweet species																			
Acacia nilotica	***	****	****	***						**		*						*	*
Aristida congesta	***	****	****	****						**							*	*	*
Eragrostis chloromelas	***	**		**								*					*	*	
Melinis repens	***	**	**	****	****					**	*	*					*	*	*
Gymnosporia buxifolia	**	**		*	**		**			***		*						*	*
Group B: old land/disturbance spp.																			
Bothriochloa spp.	*	**		****	***	*													*
Cynodon dactylon	*	***		****	**	**	****	****	****										*
Hyparrhenia coarse spp.	*	*	*	*	***		**	****											*
Sporobolus pyramidalis/fimbriatus	*			**	*	*	*	****											*
Group C: wetland/rivcrine species																			
Imperata cylindrica				*		**													
Andropogon appendiculatus						**													
Eragrostis lappula						**													
Phragmites spp.				*		**	****							*					
Group D: thicket species																			
Ficus ingens										**	***	*							*
Iboza sp.	*	*								***	*	**							
Obetia tenax										**	*	*		*					
Euphorbia ingens	*	*		*						**	****	**		*					
Hippobromus pauciflorus	*	**		*			*			**	***	****		*	*				
Pappea capensis	*	**		*			*			***	**	***		*			*		
Panicum maximum	*	**		*			***	****		****	**	**			*				*
Group E: thicket and forest species																			
Rapanea melanophloes											*			**	****	***	*	*	*
Zanthoxylum capense	*						*	*		*	*	***		*	**	*			
Englerophytum magalismontanum	*									**	*	*		***	*	***	*	*	*
Maytenus undata	*						*			**	****	***		*	**		*		
Cussonia spicata	*	*	*	*			*				****	***	****	***	****	***			*
Dalbergia armata	*										**	***		****	*	*			*
Pittosporum viridiflorum											*			**	**	**			
Plectranthus sp.											*		****		**	***			
Rhus chirindensis	*			*							****	**	****	*	*	***			*
Syzygium gerrardii												*		*	*	****			
Tricalysia sp.												*		*	***	***			
Trimeria grandifolia												*		*	****	*			
Allophylus sp.											*	**		**	**				
Apodytes dimidiata												*		**	**	*			
Canthium inerme		*									*	*		*	*	**	*		*
Carissa bispinosa												*	****		**	***			
Clausena anisata		*								*	*	*		*	***	**			
Combretum kraussii								****				*		**	**	**			
Ekebergia capensis												*		*	**	**			
Group F: forest species																			
Curtisia dentata														*	**	****			
Rhoicissus rhomboidea														**	**	***			
Oplismenus spp.									****					****	**	****			*
Group G: sour species																			
Alloteropsis semialata subsp. *ecklonii*																	*	***	*
Cephalanthus natalensis																	*	*	*
Ctenium concinnum																	**	**	*
Erica drakensbergensis																	*	*	*
Eulalia villosa																	*	**	**
Panicum ecklonii																	*	**	*
Protea caffra																	*	**	*
Rendlia altera																	*	***	*
Aristida canescens/transvaalensis	*				*						*						****	*	*
Diheteropogon filifolius					*												**	***	*
Loudetia simplex	**		**		*				*	*							****	****	***
Melinis nerviglume	*									*							***	**	**
Monocymbium ceresiiforme	*		**														*	***	*
Panicum natalense	*		**														***	****	***
Trachypogon spicatus	**		**														**	***	**

TABLE 1.—Synoptic table with constancy values for selected common and diagnostic species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each). Symbols refer to the following constancy ranges: * 1–25%, ** 26–50%, *** 51–75%, **** 76–100% (continued)

	'mixed' split in ALOC dendrogram									thicket/forest split							'sour' split		
	mixed			old land		wetland/ river		alien		thicket			forest				sour grassland		
Community number ➡	2	3	4	1	7	5	6	8	9	13	14	15	16	10	11	12	17	18	19
Group H: important but non-diagnostic grass species																			
Heteropogon contortus	****	****	***	***	***	*	*			****	*	*					***	*	**
Themeda triandra	***	***	*	*	****	**	**	****			**	***			*		***	****	****
Eragrostis curvula	*	**		**	***	**	**	****	****	*	***	***			*		**	*	*
Cymbopogon spp.	**	*	***	*	**	**	*				*	*					**	*	****
Group I: important but non-diagnostic woody species																			
Euclea crispa	***	****		**	*	*	***	****	****	**	****	****		***	***		**	*	**
Rhoicissus tridentatus	*	**		*	*		**		****	**	****	***		**	***			*	*
Rhus pentheri	**	****		*			**			**	**	***			**		*	*	*



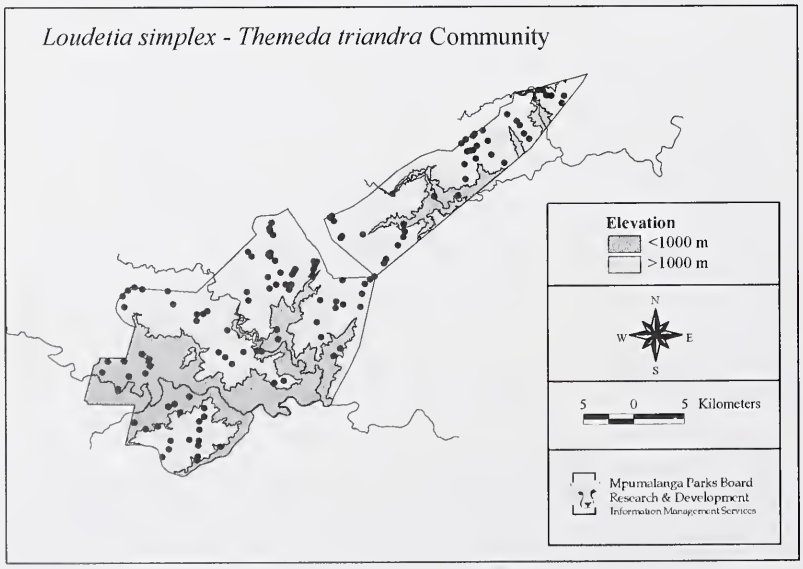


FIGURE 9.—Respective occurrence of the *Acacia nilotica–Heteropogon contortus* and the *Loudetia simplex–Themeda triandra* Community based on sampling localities. Note the former community occurring mostly below 1 000 m and the latter above 1 000 m elevation including some higher hills within the lower Komati Valley.

grass layer is also very distinct compared to any other community encountered. *Andropogon chinensis* is most conspicuous. As with other communities in the Komati Valley, *Heteropogon contortus* is one of the most important components out of a total of 19 grass species recorded. Grazing pressure was very light probably because of the very steep nature of the terrain.

5. *Miscanthus junceus–Andropogon appendiculatus* Short Grassland (classification group 4 & 16, n = 6)

This is an azonal landscape unit of wetlands along small perennial rivers and in seepage areas at low to medium elevation. It is a fairly open unit with generally only a sparse to open shrub component. Only small areas of this unit occur on the SGR. Classification groups 4 and 16 are floristically fairly dissimilar, but a unique combination of grass species still typifies these wetlands. These are *Agrostis lachnantha, Andropogon eucomus, A. appendiculatus, Eragrostis lappula, Ischaemum fasciculatum* and *Miscanthus junceus* (Table 1). Total grass diversity is 24 species.

6. *Combretum erythrophyllum–Cynodon dactylon* Low Woodland (classification group 8, n = 6)

This community occurs as a narrow strip of riverine vegetation on the banks of the Komati River. *Combretum erythrophyllum* is the dominant woody component. Another 35 woody species were recorded. Further downstream, east of the Kromberg, more tropical elements such as *Breonadia salicina* and *Ficus sycomorus* start appearing. The highest annual mean of daily maximum and monthly means of daily minimum temperatures for the Reserve are expected for this specific part of the Reserve based on the results of climatic modeling (Anon. 1986). Alien species of note are *Melia azedarach* and *Sesbania punicea*. Other alien species of lesser importance are *Acacia mearnsii, Cassia floribunda, Lantana camara* and *Psidium guajava*. The grass cover is generally less than 50% with *Cynodon dactylon, Panicum maximum* and *Phragmites* sp. being most prominent. In total, 15 grass species were recorded.

7. *Lippia javanica–Hyparrhenia* spp. Short Shrubland (classification group 13, n = 8)

This community is physiognomically dominated by tall 'thatch' grass species such as *Cymbopogon* spp., *Hyparrhenia* spp. and *Hyperthelia dissoluta* (Table 1). Other common tall grass species are *Bothriochloa* spp., *Eragrostis curvula, Sporobolus africana* and *S. pyramidalis*. Total grass diversity is 25 species. It is essentially the counterpart of the *Cynodon dactylon–Melinis repens* Community on old lands but occurs at elevations above 1 000 m as small patches of old lands or in small saddles in the landscape. The old lands are not much grazed, but the saddle positions are much favoured by cattle for grazing and resting. This is probably because of the gentler topography, sheltered microclimate and increased nutrient cycling established through the more concentrated activities of animals on these particular sites (Blackmore *et al.* 1990). Only eight woody species were recorded of which only *Lippia javanica* is fairly ubiquitous.

8. *Acacia mearnsii–Eragrostis curvula* Short Woodland (classification group 20, n = 1)

This alien-dominated community is found north of the Msoli River along some drainage lines and in areas of previous disturbance such as mining, roadsides and settlement sites. The most conspicuous feature is the dominance of *Acacia mearnsii* (black wattle) coupled with a low diversity of other species. Grass cover is sparse with *Eragrostis curvula* being the most prominent species. Only seven grass species were recorded.

9. *Solanum aculeastrum–Eragrostis curvula* High Shrubland (classification group 10, n = 1)

This community was only observed in a few small patches. It occurs as a closed shrubland of *Solanum aculeastrum* on disturbed sites at elevations above 1 400 m in moist areas in the north and east of the SGR. It is a species-poor community containing certain forest elements such as *Celtis africana, Halleria lucida* and the grass *Oplismenus* sp. under its cover and protection from fire. Only four grass species were recorded on this sample plot.

10. *Dalbergia armata–Keetia gueinzii* Tall Forest (classification group 6, n = 9)

This community is found towards the eastern side of the SGR at relatively low elevations of 800 to 1 200 m along drainage lines. It is particularly prominent along the lower reaches of the Msoli River and through the central valleys of the northeastern panhandle extension of the Reserve. It is a closed dry forest with an important thorny and spiny element (*Acacia ataxacantha* and *D. armata*) (Table 1). A total of 91 different woody species was recorded which is more than in any other community. The grass component of nine species is more diverse than any of the other forest communities, probably because the lower canopy and frequent gaps allow more light to reach the forest floor. The most common species however is *Oplismenus hirtellus* which is a typical forest-floor species (Table 1).

11. *Rapanea melanophloeos–Trimeria grandifolia* Short Forest (classification group 18, n = 7)

This forest community is not necessarily associated with drainage lines in the landscape, unlike Community 10. It occurs mostly in areas with annual rainfall above 1 100 mm on upper slopes in the landscape in the north and northeastern part of the Reserve. The canopy is characterised by a combination *of Cussonia spicata, Rapanea melanophloeos* and *Trimeria grandifolia* (Table 1). Elements from drier communities occur, namely *Acacia ataxacantha, Clausena anisata, Diospyros whyteana* and

Euclea crispa. Total woody species diversity is 64 species. The grass component is mostly limited to *Ehrharta erecta* and *Oplismenus hirtellus*. Forbs have a relatively high cover of 25–50%.

12. *Syzygium gerrardii–Xymalos monospora* Tall Forest (classification group 22, n = 4)

This tall forest occurs in wet areas in the east that receive more than 1 200 mm of annual rainfall. *Syzygium gerrardii* is the typical dominant upper canopy species. Another 63 woody species were recorded. Grasses are limited to typical forest species such as *Oplismenus hirtellus, Panicum deustum, Setaria megaphylla*, and the climbing *Prosphytochloa prehensilis*.

13. *Ptaeroxylon obliquum–Panicum maximum* Short Thicket (classification group 9, n = 6)

This community occurs at low elevation in the Komati and Msoli Valleys where it is found on steep, mostly north-facing slopes overlooking the river. Due to its low elevation, steep slope with shallow soils and northern aspect, this is probably one of the most xeric habitats in the SGR. This includes some extremely broken dolerite ridges. Soils are mostly sandy loam with 15% to 20% clay. The woody component is relatively diverse with 64 species recorded. *Ptaeroxylon obliquum* and *Ruttya ovata* are the most frequently occurring woody species. Common species also found in closed communities at low elevation are *Olea europea* subsp. *africana*, *Pappea capensis* and *Zanthoxylum capense*. This is the only community in which *Spirostachys africana* was encountered. *Croton gratissimus* was observed on dolerite ridges. *Panicum maximum* was recorded in each of the six sample plots belonging to this community (Table 1). Only 14 other grass species were recorded of which *Heteropogon contortus* is the most prominent. Forb cover is generally below 5%. A succulent component mostly consisting of *Aloe* spp., *Euphorbia ingens* and *E. evansii* (only recorded in this community) was encountered in every plot.

14. *Acacia caffra–Dombeya rotundifolia* Short Thicket Community (classification group 11, n = 5)

This closed community occurs exclusively on the granodiorite-adamellite outcrops in the southern foothills of the Kromberg. Sample plots were located on south to southwest aspects. Soils consisted of loamy sand (10–15% clay). The community is found on steep slopes but also in some old, deeply incised (3–5 m) erosion gullies. *Acacia caffra*, *Cussonia spicata*, *Diospyros whyteana* and *Dombeya rotundifolia* have a 100% constancy value (Table 1). Another 50 woody species were identified. Forest species such as *Rhus chirindensis* occur within the shelter offered by the erosion gullies. Only 13 grass species were recorded with limited cover values because of the dense woody canopy. As a consequence, the grass component contains several species with forest affinities, such as *Panicum deustum* and *Setaria megaphylla*.

15. *Diospyros whyteana–Hippobromus pauciflorus* Short Thicket (classification group 21, n = 11)

This closed community is found at the transition of the Komati Valley to the mountains in the north and the Kromberg in the south. There are many similarities with the previous community both in terms of structure and composition. As in the previous community *Acacia caffra, Cussonia spicata*, *Diospyros whyteana* and *Dombeya rotundifolia* are prominent. *Hippobromus pauciflorus* occurs much more frequently and with higher cover values. However, the greatest difference lies in the occurrence of *Berchemia zeyheri*, *Grewia occidentalis* and *Olea europea* subsp. *africana*. These important browsing species were not encountered in the previous community. The limited grass cover of only 12 species consists mostly of shade loving grasses. Forb cover is mostly in the 5–25% class.

16. *Buddleja saligna–Aloe arborescens* Short Forest (classification group 12, n = 1)

This short forest is only known from an isolated patch on a steep, rocky, south-facing upper slope of the Kromberg. It is a very distinct community in terms of composition. *Aloe arborescens*, *Buddleja saligna* and *Chionanthus foveolatus* make up most of the cover. *B. saligna* was only observed in this sample plot. No grasses were observed. The forb cover of 5–25% consisted mostly of Acanthaceae. Fern cover was 1–5% with *Asplenium* sp. and *Elaphoglossum* sp. being observed.

17. *Loudetia simplex–Aristida canescens* Low Grassland (classification group 5, n = 24)

This community is characteristically found on chert ridges often in an exposed summit position or on steep north-facing upper slopes of the Kromberg and the northern mountains. The sample sites were invariably extremely rocky. This combination of factors results in a xeric community despite its generally high elevation. Woody cover is mostly below 25%. A total of 48 woody species was recorded in this sparse to open shrubland. *Xerophyta retinervis* is a conspicuous element. The grass layer is fairly open for this type of sour grassland. Total grass diversity was 46 species. This community is subject to higher grazing pressures than Community 18. Thirty percent of the sample plots had a medium to high grazing pressure as compared to only 3% in the *Loudetia simplex– Themeda triandra* Community. *Aristida canescens, Diheteropogon amplectens*, *Loudetia simplex* and *Themeda triandra* occur in more than 75% of the plots and achieve cover values of 25% or more. Of interest is the relatively high frequency of *Heteropogon contortus*, whereas this species is generally not prevalent at elevations above 1 200 m. This reflects the relatively sweet nature of this community. Almost 50% of the sample plots had a small succulent component as compared to only 15% in Community 18.

18. *Loudetia simplex–Themeda triandra* Low Grassland (classification group 17,19 & 24, n = 134)

This community is found across all physiographic units including isolated higher hills within the Komati

Valley (Figure 9). It is the dominant community in all the higher parts of the SGR in a variety of landscape positions and aspects. It is a typical sour grassland in which the woody component is absent in 28% of the samples. A total of 55 woody species was recorded. The presence of several species of *Protea* (*P. caffra, P. gaguedii, P. roupelliae* and the Barberton endemic *P. comptonii*) is characteristic. The grass layer is generally very dense and shorter than 0.5 m. A total of 53 species was recorded of which 10 with frequencies exceeding 60% consistently make up the bulk of the community in terms of cover and phytomass. These include *Loudetia simplex, Panicum natalense, Themeda triandra, Trachypogon spicatus* and *Tristachya leucothrix* (Table 1). A number of 'wire' grasses occur, namely *Diheteropogon filifolius, Elionurus muticus, Microchloa caffra* and *Rendlia altera*. A large diversity of forbs is present, but their cover does generally not exceed 5%. Geophytes, including *Brunsvigia* sp., *Eucomis* sp., *Ledebouria* spp., *Scilla* sp. and *Watsonia* spp. occur.

19. *Themeda triandra–Cymbopogon* spp. Short Grassland (classification group 7 & 14, n = 66)

This community is also widespread outside of the Komati Valley. Its peak distribution is at lower elevation than the typical sour grassland of Community 18. It is also found less on the sandstones and quartzites of the Figtree and Moodies subgroups. A total of 65% of the sample plots have soils heavier than loamy sand (10–15% clay) compared to 48% in Community 18. It is generally a more mixed community with more woody elements (both in terms of species and cover). A total of 55 woody species was recorded in both communities but the previous community had twice as many sample plots. Only 12% of the sample plots had no woody species present compared with 28% in Community 18. No single woody species characterises this community. A combination of some of the following species is often found: *Acacia caffra, Euclea crispa, Faurea speciosa, Lippia javanica* and *Rhoicissus tridentata*. If the habitat factors and woody species are taken into account, this community represents a broad transition from woodlands in the Komati Valley to the sour grasslands in the higher mountains. The grass layer is taller than in Community 18 at 0.5 to 1 m. It is also more diverse with a total of 60 species having been recorded. The very dense grass layer has as most important species *Themeda triandra* and *Cymbopogon* spp. (mostly *C. excavatus*). Forb cover is between 5% and 25% in half of the sample plots.

Vegetation of the SGR in relation to similar environments

Broad environmental determinants of grass and woody structure and composition have been identified for the SGR including land use history, elevation and geology. These are the same as those identified for similar montane habitats along the eastern Escarpment (Matthews *et al.* 1994).

At the SGR, disturbance, particularly in the form of cropping and settlement, results in a very specific vegetation overriding other factors. This is similar to findings for the Legalameetse Nature Reserve, 220 km to the north of the SGR (Stalmans 1990) and the high-altitude grasslands of northern KwaZulu-Natal, 200 km to the south (Eckhardt *et al.* 1996).

The mixed and sour communities found in the SGR are respectively linked to the alluvial and mafic/ultramafic volcanic substrata on the one hand and the dystrophic felsic lavas, and sedimentary sandstones/quartzites on the other hand. Similarly, the first split in the classification of the vegetation of the Suikerbosrand Nature Reserve, 250 km west of the SGR, could be ascribed to the occurrence of two very different geological substrates, namely one of volcanic origin and one consisting of sedimentary dystrophic quartzite (Bredenkamp & Theron 1976).

Within individual geological substrata, elevation plays an important role in governing water availability (Ferrar & Scheepers 1988) both through increased rainfall and reduced evapotranspiration (Scheepers 1978). In the SGR, this is reflected in the occurrence of sour grasses at high elevation and on cooler and moister southern aspects of sour grasses, whereas mixed and sweet species occur at lower elevation and on warmer, northerly aspects (Figure 9). The same pattern has been observed in the Natal Drakensberg (Walker 1988) and the Bewaarkloof Mountains, 250 km to the northwest of the SGR (Stalmans & De Klerk 1992).

Individual communities could not be exactly matched to each other across different studies as only grass and woody species were used in the SGR survey as compared to the full species cover assessment in most other studies. Scaling issues remain a problem, particularly as the scale of results is often determined by the study objectives. Notwithstanding the differences in approach, certain mixed, sour and forest communities of the SGR are mirrored in other areas.

With regard to mixed communities, the *Cynodon dactylon–Melinis repens* Short Shrubland in the SGR is similar to the *Sporobolus africanus–Eragrostis curvula* Young Secondary Grassland on abandoned fields in the Mlilwane Wildlife Sanctuary, 50 km south of the SGR (Coetzee & Nel 1978). Mlilwane is underlain by granites and the *Combretum molle–Dombeya rotundifolia* Subhumid Mountain Bushveld corresponds to the *Acacia caffra–Dombeya rotundifolia* Short Thicket Community occurring on the granodiorite-adamellite outcrops of the SGR.

With regard to sour communities, the *Loudetia simplex–Themeda triandra* Low Grassland found in the SGR has many affinities to communities such as the *Helichrysum wilmsii–Andropogon schirensis* Low Closed Grassland of the Subhumid Mistbelt and several communities of the Humid Mistbelt grasslands of the Plateau Escarpment as defined by Deall *et al.* (1989) for the Sabie area, 150 km to the north of the SGR. This SGR community also corresponds to the *Loudetio simplicis–Alloteropsidetea semi-alatae* class (as defined by Matthews *et al.* 1994) of the relatively low altitude (below 1 600 m asl) areas of the North-eastern Mountain Sourveld in the Sabie area.

With regard to forest communities, the *Syzygium gerrardii–Xymalos monospora* Tall Forest in the SGR has great affinities with other mesophytic forests along the escarpment (Von Breitenbach 1990). *Cassipourea malosana*, *Cola greenwayi, Englerophytum natalense, Garcinia gerrardii*, *Micrococca capensis* and *Ocotea kenyensis* are exclusive to this moist forest. During a survey of Swaziland forests (Masson 1991), these species were only recorded on the Swaziland side of the Mlembe Mountain which straddles the SGR/Swaziland border. The presence of *O. kenyensis* was seen as a strong link to the Transvaal Drakensberg escarpment forests to the north, whilst *G. gerrardii* provides a link with the Indian Ocean coastal belt forests to the south (Masson 1991). Morgenthal & Cilliers (1997) similarly list *C. greenwayi, O. kenyensis* and *G. gerrardii* as species of phytogeographical importance in the 85 ha Pedlar's Bush forest, which is situated less than 3 km northwest of the SGR. They consider this as an area where an unique overlap of species common to the Transvaal and Natal forest has occurred.

Plant community suitability for herbivores

The value to herbivores of the communities described above needs to bc evaluated at different scales following the ecological hierarchies identified by Senft *et al.* (1987).

Out of the 428 sample plots, a total of 342 are accessible to the herbivores. Their location is not far enough away from a perennial source of water as to markedly influence herbivore distribution. The grazing impact on these plots was rated from none to light (factor 1), medium (factor 2) and heavy (factor 3). Based on the frequency distribution of the grazing classes, a composite value was determined for each community.

In terms of their ranked grazing values (Table 2), the first six communities are all found on the mixed and forest/thicket side of the primary split in the dendrogram (Figure 6). This supports the premise that this cluster represents the more eutrophic and palatable part of the SGR. These communities occur on a basic geology at lower elevation, mostly in the Komati Valley. Forests within this cluster, however, are not much utilised.

TABLE 2.—Rank of the plant communities in the SGR based on the frequency distribution of grazing values in the sample plots. Ranking is in descending order from most to least utilised. Forest and alien communities are not listed

Rank	Community name	ALOC group	Community number
1	*Cynodon dactylon–Melinis repens*	1	1
2	*Acacia nilotica–Euclea crispa*	3	3
3	*Miscanthus junceus–Andropogon appendiculatus*	4.16	5
4	*Combretum erythrophyllum–Cynodon dactylon*	8	6
5	*Lippia javanica–Hyparrhenia* spp.	13	7
6	*Acacia nilotica–Heteropogon contortus*	2,23	2
7	*Loudetia simplex–Aristida canescens*	5	17
8	*Diospyros whyteana–Hippobromus pauciflorus*	21	15
9	*Acacia caffra–Dombeya rotundifolia*	11	14
10	*Themeda triandra–Cymbopogon* spp.	7,14	19
11	*Loudetia simplex–Themeda triandra*	17,19,24	18
12	*Combretum apiculatum–Xerophyta retinervis*	15	4
13	*Ptaeroxylon obliquum–Panicum maximum*	9	13

The presence of more palatable species such as *Berchemia zeyheri* in the *Diospyros whyteana–Hippobromus pauciflorus* Community as opposed to the otherwise very similar *Acacia caffra–Dombeya rotundifolia* Community is reflected in their respective rankings. Similarly, the transitional nature of the *Themeda triandra–Cymbopogon* spp. Community which falls between the mixed communities in the Komati Valley and the typical sour grasslands of the *Loudetia simplex–Themeda triandra* Community on the higher mountain slopes, is correctly reflected in its ranking. The low ranking of the *Combretum apiculatum–Xerophyta retinervis* and *Ptaeroxylon obliquum–Panicum maximum* Communities reflects their occurrence on extremely steep slopes or low cliffs which makes access to herbivores extremely difficult.

The ranked utilisation value of the communities thus reflects the theoretical delineation into mixed and sour communities based on palatability values obtained from the literature. This is also an indication that the delineation of individual communities based on their floristic make-up is relevant in terms of their significance to herbivore utilisation. Therefore this delineation becomes useful from a game management perspective.

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REFERENCES

ACOCKS, J.P.H. 1975. Veld types of South Africa, edn 3. *Memoirs of the Botanical Survey of South Africa* No. 40.

ANON. 1986. *Master plan and management guidelines for the Songimvelo Natural Resources Area.* Chris Mulder Assoc. Unpublished.

ANON. 1998. *Phase 3 report in respect of a study to examine the socio-economic impact of the Maputo Development Corridor on tourism in Mpumalanga Province.* Grant Thornton Kessel Feinstein. Unpublished report to the Maputo Development Corridor Provincial Technical Committee.

AUSTIN, M.P. & HEYLIGERS, P.C. 1989. Vegetation survey design for conservation: gradsect sampling of forests in north-eastern New South Wales. *Biological Conservation* 50: 13–32.

BARNES, D.L., RETHMAN, N.F.G., BEUKES, B.H. & KOTZE, G.D. 1984. Veld composition in relation to grazing capacity. *Journal of the Grassland Society of southern Africa* 1: 16–19.

BELBIN, L. 1988. *PATN: Pattern Analysis Package Reference Manual.* CSIRO Division of Wildlife and Ecology, Canberra, Australia.

BLACKMORE, A.C., MENTIS, M.T. & SCHOLES, R.J. 1990. The origin and extent of nutrient-enriched patches within a nutrient-poor savanna in South Africa. *Journal of Biogeography* 17: 463–470.

BREDENKAMP, G.J. & THERON, G.K. 1976. Vegetation units for management of the grasslands of the Suikerbosrand Nature Reserve. *South African Journal of Wildlife Research* 6: 113–122.

COETZEE, B.J. & NEL, P.J. 1978. A phytosociological reconnaissance of Mlilwane Wildlife Sanctuary, Swaziland. *Koedoe* 21: 1–36.
DEALL, G.B. & THERON, G.K. 1990. Ordinations as a tool for substantiating and interpreting floristic classifications: a case study. *Bothalia* 20: 223–227.
DEALL, G.B., THERON, G.K. & WESTFALL, R.H. 1989. The vegetation ecology of the Eastern Transvaal Escarpment in the Sabie area. 2. Floristic classification. *Bothalia* 19: 69–89.
DELCOURT, H. R. & DELCOURT, P.A. 1988. Quarternary landscape ecology: relevant scales in space and time. *Landscape Ecology* 2: 23–44.
EASTMAN, J.R. 1992. *IDRISI.* Clark University Graduate School of Geography. Worcester, Massachusetts.
ECKHARDT, H.C., VAN ROOYEN, N. & BREDENKAMP, G.J. 1993. Use of Braun-Blanquet data for the assessment of veld condition and grazing capacity in grassland. *African Journal of Range & Forage Science* 10,1: 41–46.
ECKHARDT, H.C., VAN ROOYEN, N. & BREDENKAMP, G.J. 1996. The plant communities and species richness of the *Alepidea longifolia–Monocynbium ceresiiforme* High-altitude Grassland of northern KwaZulu-Natal. *Koedoe* 39,1: 53–68.
EDWARDS, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 14: 705–712.
ELLERY, W.N., SCHOLES, R.J. & SCHOLES, M.C. 1995. The distribution of sweetveld and sourveld in South Africa's grassland biome in relation to environmental factors. *African Journal of Range & Forage Science* 12,1: 38–45.
FABRICIUS, C. & MENTIS, M.T. 1990. Seasonal habitat selection by eland in arid savanna in southern Africa. *South African Journal of Zoology* 25: 238–244.
FABRICIUS, C. & MENTIS, M.T. 1992. Modelling the habitat relations of kudu in arid savanna. *South African Journal of Science* 88: 280–284.
FERRAR, A.A. & SCHEEPERS, J.C. 1988. Vegetation types. In A.A. Ferrar, G. Isaacs & J.R. Stacey, *Environmental conservation features of the Transvaal Escarpment.* Occasional Report 31. CSIR, Pretoria.
FOURIE, S.P., JACOBSEN, N.H.G., KLEYNHANS, C.J. & TARBOTON, W. 1988. Biogeographical importance and species/area warranting particular conservation attention. In A.A. Ferrar, G. Isaacs & J.R. Stacey, *Environmental conservation features of the Transvaal Escarpment.* Occasional Report 31. CSIR, Pretoria.
GABRIEL, H.W. & TALBOT, S.S. 1984. *Glossary of landscape and vegetation ecology for Alaska.* BLM–Alaska Technical Report 10. US Department of the Interior.
GAMBLE, F. 1988. Climate of the Transvaal Escarpment. In A.A. Ferrar, G. Isaacs & J.R. Stacey, *Environmental conservation features of the Transvaal Escarpment.* Occasional Report 31. CSIR, Pretoria.
GEOLOGICAL SURVEY 1986. *Geology map 1:250 000 geological series: 2430 Barberton.* Government Printer, Pretoria.
GILLISON, A.N. & BREWER, K.R.W. 1985. The use of gradient directed transects or gradsects in natural resource surveys. *Journal of Environmental Management* 20: 103–127.
HILL, M.O. 1979a. *DECORANA—a FORTRAN program for detrended correspondence analysis and reciprocal averaging.* Cornell University, Ithaca, New York.
HILL, M.O. 1979b. *TWINSPAN—a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes.* Cornell University, Ithaca, New York.
HILL, M.O. & GAUCH, H.G. 1980. Detrended correspondence analysis: an improved ordination technique. *Vegetatio* 42: 47–58.
JONGMAN, R.H.G., TER BRAAK, C.F.J. & VAN TONGEREN, O.F.R. 1987. *Data analysis in community and landscape ecology.* Pudoc, Wageningen.
LAND TYPE SURVEY STAFF. 1989. Land types of the map 2530 Barberton. *Memoirs of the Agricultural Natural Resources of South Africa* 13.
LOW, A.B. & REBELO, A.G. (eds). 1996. *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs & Tourism, Pretoria.
LOWE, D.R. & BYERLY, G.R. (eds). 1999. Geologic evolution of the Barberton Greenstone Belt, South Africa. *Geological Society of America Special Paper* 329.
MASSON, P.H. 1991. *The conservation status of highveld forests in Swaziland.* Flora Conservation Committee Report No. 91/3. Botanical Society of South Africa.
MATTHEWS, W.S., BREDENKAMP, G.J. & VAN ROOYEN, N. 1994. The phytosociology and syntaxonomy of relatively low-altitude areas in the North-eastern Mountain Sourveld, in the eastern Transvaal Escarpment region. *Koedoe* 37,2: 73–87.
MATTHEWS, W.S., VAN WYK, A.E. & BREDENKAMP, G.J. 1993. Endemic flora of the northeastern Transvaal Escarpment, South Africa. *Biological Conservation* 63: 83–94.
MORGENTHAL, T.L. & CILLIERS, S.S. 1997. *The ecology and conservation of Pedlar's Bush.* Potchefstroom University. Unpublished.
MUELLER-DOMBOIS, D. & ELLENBERG, H. 1974. *Aims and methods of vegetation ecology.* John Wiley, New York.
NATIONAL WORKING GROUP FOR VEGETATION ECOLOGY 1986. *Soil classification according to the binomial classification system.* Technical Communication 3.
PARTRIDGE, T.C. & MAUD, R.R. 1987. Geomorphic evolution of southern Africa since the Mesozoic. *South African Journal of Geology* 90: 179–208.
RUTHERFORD, M.C. & WESTFALL, R.H. 1986. Biomes of southern Africa—an objective categorisation. *Memoirs of the Botanical Survey of South Africa* No. 54.
SENFT, R.L., COUGHENOUR, M.B., BAILEY, D.W., RITTENHOUSE, L.R., SALA, O.E. & SWIFT, D.M. 1987. Large herbivore foraging and ecological hierarchies. *BioScience* 37: 789–799.
SCHEEPERS, J.C. 1978. Vegetation of the Westfalia Estate on the Northeastern Transvaal Escarpment. *Memoirs of the Botanical Survey of South Africa* No. 42.
STALMANS, M. 1990. *Vegetation survey for the scientific management of the Lekgalameetse Nature Reserve.* M.Sc. (Botany), University of the Witwatersrand.
STALMANS, M. & DE KLERK, G. 1992. Protea landscapes in the Bewaarkloof Mountains, Transvaal. *Protea Atlas Newsletter* 14: 8, 9.
TER BRAAK, C.J.F. 1986. Canonical correspondence analysis: a new eigenvector technique for multivariate direct gradient analysis. *Ecology* 67: 1167–1179.
TER BRAAK, C.J.F. 1992. *CANOCO—a FORTRAN program for canonical community ordination.* Microcomputor Power, Ithaca, New York, USA.
TER BRAAK, C.J.F. & PRENTICE, I.C. 1988. A theory of gradient analysis. *Advances in Ecological Research* 18: 271–317.
VAN DER MERWE, P.D.R. & RETIEF, E.F. 1995. *The Songimvelo Game Reserve inhabitants: individual data and background information.* Department of Constitutional Development. Unpublished.
VAN OUDTSHOORN, F.P. 1991. *Guide to grasses of South Africa.* Briza Publications, Pretoria.
VILJOEN, R.P. & VILJOEN, M.J. 1971. The geological and geochemical evolution of the Onverwacht volcanic group of the Barberton Mountain land, South Africa. *Geological Society of Australia Special Publication* 3: 133–149.
VON BREITENBACH, F. 1990. *Reports on indigenous forests.* Part 1. Department of Environment Affairs, Forestry Branch, Pretoria.
WALKER, R.S. 1988. A gradient analysis of grassed mountain catchments in the Natal Drakensberg. *Journal of the Grassland Society of southern Africa* 5: 179–185.
WITT, J. 1983. *Preliminary report on prehistoric and historic artefacts in nature reserves in the Barberton district.* Unpublished.

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each)

Species	Community number																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Acacia																			
ataxacantha		4	11			33				67	71		17	20	55	100			
burkei		2																	
caffra	11	49	21										50	100	82		8	10	23
davyi			5		17														14
karroo	17	13	11		17	33									9			1	6
mearnsii						17		100		22									
nilotica	74	68	100	67									33		9			3	9
robusta		4													9				
sieberiana			5																
Acalypha glabrata													17	20					
Agrostis lachnanta					50														
Allophylus																			
melanocarpus															9				
sp.										33	43			20	45				
Alloteropsis semialata																			
subsp. *semialata*																			2
subsp. *ecklonii*																	8	53	14
Aloe																			
arborescens												25		20	18	100			2
marlothii	6	52	32	33									50	40	9		33	6	15
sp.													17						
Andropogon																			
appendiculatus					33														
chinensis/fastigiatus		2	5	67															
eucomus					33														
schirensis		18											33				29	60	38
Annona senegalensis	3	2					13												2
Anthocleista grandiflora										11									
Anthospermum sp.																		1	
Antidesma venosum																			2
Aphloia theiformis										11		75							
Apodytes dimidiata										33	29	25			9				
Aristida																			
bipartita		2																1	2
canescens/transvaalensis		7					13						17				100	16	11
congesta	77	73	79	100									33				13	4	6
diffusa		28	5	67													13	3	8
junciformis	6	4															4		2
Barleria rotundifolia			5										17						
Bauhinia galpinii		6	16			17				11			17		18			1	2
Berchemia zeyheri		9	32										17		36			1	
Bersama sp.										11	14								
Bewsia biflora		50		33													42	20	33
Boscia sp.			5										17						
Bothriochloa spp.	77	13	47		17		63												2
Bowkeria cymosa										33									2
Brachiaria																			
brizantha	3	10											17					1	2
deflexa													17						
eruciformis	3																		
serrata		39		33			13										29	25	20
Brachylaena discolor										11	29	25			9				3
Breonadia salicina						17				11									
Bridelia micrantha										33									
Bromus hordeaceus																			2
Buddleja																			
salicina																100			
salviifolia					17					22									5
auriculata										11	29								
Burchellia bubalina										44	29	25						1	
Caesalpinia decapetala										11									
Calpurnia aurea																			2
Canthium																			
ciliatum										11		25							
inerme			5							11	14	50		20	9		4		2
Carissa bispinosa											43	75			18	100			
Casearia gladiiformis										11									
Cassia floribunda						17													
Cassine papillosa											14								
Cassinopsis																			
ilicifolia										33	71				9				
tinifolia										33									

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each) (continued)

Species	Community number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Cassipourea malosana												25							
Catha edulis						17								20	27				3
Celtis africana									100	22	43			20	9				
Cephalanthus natalensis																	4	1	14
Chaetacme aristata		1																	
Chionanthus foveolatus		1														100	4		
Chloris virgata	6																		
Choristylis rhamnoides										11	14								
Clausena anisata			5							11	57	50	17	20	27				
Clerodendrum																			
glabrum	3	1											17	20	18				
suffruticosum															9				
Cliffortia sp.					17														
Clutia pulchella												25							
Coddia sp.		6	21	33		50								20	45				3
Cola greenwayii												25							
Combretum																			
apiculatum		44	21	67									67				4	2	5
erythrophyllum						100													
hereroense		20	5	33									17					4	2
kraussii								100		44	29	50			9				
molle		11	11										33	60	45		8	2	
zeyheri		18	5	33													13	4	3
Commiphora marlothii		1	5							11			33		36		4		
Croton gratissimus													17						
Cryptocarya																			
liebertiana												25							
woodii												25							
Ctenium concinnum																	38	34	3
Curtisia dentata										11	43	100							
Cussonia																			
natalensis		4											17		9		17	1	
paniculata		4																1	2
spicata	3	1	5			17				56	86	75		100	64	100			6
Cyathea dregei					17					22		25							
Cymbopogon spp.	9	35	21	67	33	17	38							20	9		46	24	80
Cynodon dactylon	94	10	58		33	100	25	100	100										2
Dais cotinifolia					17					22									
Dalbergia armata		2								78	14	25		40	55				2
Dichrostachys cinerea	20	12	37										17				4	1	5
Digitaria																			
diagonalis		1					13										8	7	21
flaccida																		7	
longiflora	11	4				17													
ternata						17													
Diheteropogon																			
amplectens		22		67			25										75	60	50
filifolius							13										42	73	21
Diospyros																			
lycioides	14	7	16		17	83	13			11					18		8	1	5
whyteana	3	5	26							67	57		17	100	91		21	1	6
Dombeya																			
burgessiae										56									8
rotundifolia	3	41	47	67		50							50	100	82		13	2	20
Dovyalis lucida/Scolopia mundtii												25							
Dracaena hookerana										11	14								
Ehretia spp.			11										17	20					
Ehrharta erecta var. *erecta*						17				22	57			20	18				
Ekebergia capensis										22	29	50			9				
Eleusine indica					17														2
Elionurus muticus/Digitaria monodactyla	3	28	5				13										8	32	11
Encephalartos heenanii																		1	
Englerodaphne pilosa												25							
Englerophytum																			
magalismontanum		1								67	14	75	33	20	9		17	4	2
natalense												25							
Enneapogon scoparius		2		33									17						
Eragrostis																			
aspera		1																	
capensis		11			17		13										21	21	9
chloromelas	31	55	47												9		4	2	
cilianensis	3		5																
curvula	31	21	42		50	50	63	100	100		14		17	60	55		38	7	20

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each) (continued)

Species	Community number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Eragrostis (cont.)																			
gummiflua	3	2																	
inamoena	6	1																	
lappula					33														
plana											14								
racemosa	6	32	5				13										25	52	17
rigidior	3		5																
sclerantha subsp. *sclerantha*																	4	2	2
superba	26	23	11			17												1	
Erica drakensbergensis																	4	13	6
Erythrina lysistemon			5												18				
Erythroxylum																			
delagoense	3	2	5							11			17		9				
emarginatum													17						
Euclea																			
crispa	31	67	79		17	67	25	100	100	67	57		33	80	82		29	8	32
natalensis			11							33	43				18				
Eulalia villosa																	8	37	36
Euphorbia																			
evansii													17						
ingens	3	5	5							11			50	80	45				
Eustachyus paspaloides		16	5															1	
Faurea																			
galpinii											14								
saligna		1																2	5
speciosa		5												20			25	15	23
Festuca spp.																		19	12
Ficus																			
craterostoma												25							
glumosa		2											33		9				
ingens													50	60	9				2
natalensis														20					
salicifolia													17						
sur					17	33				44				40	27				6
Garcinia gerrardii												25							
Gerrardina foliosa																		2	
Grewia																			
monticola		6											33		9				
occidentalis	3	5	26			17		100		33	43		33		73				2
Greyia sp.											29			20	9	100		1	3
Gymnosporia																			
buxifolia	3	38	37			33	13						67		9			1	9
cf. *senegalensis*				33						11	29				9				
mossambicensis									100		43	25			9				
Halleria lucida						17			100	44	43	50		20					2
Harpephyllum caffrum										11	14								
Harpochloa falx																		5	3
Heteromorpha trifoliata											43			20	18				2
Heteropogon contortus	71	99	95	67	17	17	75						83	20	9		54	22	32
Heteropyxis																			
canescens										44							4	1	
natalensis	3	7	5											40	36		8		8
Hippobromus pauciflorus	3	7	37			17				22	14		33	60	82				
Hyparrhenia																			
spp. *(filipendula/tamba)*	11	1	5			33	75	100											8
spp. (cf. *hirta*)	37	43	16		17		63	100						20			25	8	21
Hyperacanthus amoenus		2													9				
Hyperthelia dissoluta	46	62	42	33			13						33	20			17	6	6
Iboza sp.		6	21										67	20	45				
Ilex mitis										11		25							
Imperata cylindrica	3				33														
Indigofera swaziensis																			3
Ischaemum fasciculatum					33					11									
Jasminum sp.		1																	
Justicia campylostemon												25							
Keetia gueinzii										78		50							
Koeleria capensis																		19	5
Kotzschia parvifolia																		2	3
Lannea discolor		16	11	33									33		18			1	2
Lantana camara	3	1				17								20			4		
Leucosidea sericea																			2
Lippia javanica	17	7	26			17	88	100						40			17		21
Lopholaena sp.																	4		2

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each) (continued)

Species	Community number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Loudetia simplex		34		33			13						17				92	96	53
Mackaya bella												25							
Maerua																			
angolensis		1																	
racemulosa												25							
rosmarinoides													17						
Maesa lanceolata					17				100	44		50						1	6
Maytenus																			
acuminata											14	50			9				
peduncularis										33	29				9				
undata		5				17				11	29		33	80	64		4		
Melia azedarach						33													
Melinis																			
nerviglume		20											17				67	29	44
repens	86	61	37	33			88						33	20	18		13	4	8
Michrochloa caffra	3	9															21	14	12
Micrococca capensis												25							
Mimusops zeyheri			5																
Miscanthus junceus					50														
Monanthotaxis caffra										22		25			9				
Monocymbium ceresiiforme		1		33													8	62	14
Mundulea sericea		2	5	33															
Myrica pilulifera																		1	2
Myrothamnus flabellifolia																	4		
Myrsine africana			5								14				9				
Nuxia congesta											14								
Obetia tenax										22			33	20	9				
Ochna																			
cf. *natalitia*													17				21		
forest											29	75			9				
Ocotea kenyensis												25							
Olea																			
capensis subsp. *enervis*													17				4		
europaea		2	32			33							50		73				
Oplismenus spp.									100	78	29	100							2
Otholobium sp.																		1	2
Oxyanthus speciosus												100							
Ozoroa sphaerocarpa		27	11	33													4	6	8
Pachystigma macrocalyx										11				20			13		2
Panicum																			
deustum												25		20	36				
ecklonii																	4	50	20
maximum	11	7	32			83		100			14		100	40	36			1	3
natalense		4		33									67	40	55		71	79	53
Pappea capensis	3	6	32			17				11							4		
Parinari curatellifolia																		5	
Paspalum																			
scrobiculatum	6	1			17		25										4	4	9
urvillei					17														
Passerina filiformis					33					11									
Pavetta																			
edentula	3	27		33									17		9		21	4	3
galpinii												25							
gardeniifolia										22			17		18				
Peddia africana										11		50							
Peltophorum africanum	14	20	26			17							50		27		4	1	3
Pennisetum																			
clandestinum							13												
macrourum					17														2
Pentaschistis chippindalliae																		2	
Perotis patens	9	6															4		
Phragmites spp.	9				33	83				22									
Phyllanthus reticulatus			5								14								
Phymaspermum bolusii																			3
Pittosporum viridiflorum										33	43	50		20					
Plectranthus sp.											29	75		20	18	100			
Podocarpus latifolius												75							
Pogonarthria squarrosa	23	12	5														8		2
Prosphytochloa prehensilis												25						1	
Protea																			
caffra																	8	36	18
comptonii																	4	3	
gaguedii																		1	3

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each) (continued)

Species	Community number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Protea (cont.)																			
roupelliae																	4	13	
Protorhus longifolia										33	14	50			9				
Prunus africana										11									
Psidium guajava						17													
Psychotria capensis												50		20			21	8	8
Psydrax sp.												25				100	4		
Ptaeroxylon obliquum			5										83		9				
Pterocarpus angolensis		4	11														8	1	3
Pterocelastrus echinatus										11	29			20			17	3	5
Rapanea melanophloes										33	86	75		20			4	2	5
Rauvolfia caffra										44									
Rawsonia lucida										22									
Rendlia altera																	25	69	12
Rhamnus prinoides			5							22	57								
Rhoicissus																			
revoilii											29					100			
rhomboidea										33	29	75							
tomentosa										56					9				
tridentatus	6	20	42			50	25		100	33	57		33	80	64			1	23
Rhus																			
chirindensis	3	1								11	43	75		80	36	100			2
lancea						17													
lucida						17				44	71								
pentheri	20	33	79			17					29		33	40	73		8	1	6
pyroides					17					11	29				9				8
rehmanniana		9	11				25							40			21	2	12
rogersii																			2
sp.		4	5																2
transvaalensis																			2
tumilicola			5				25										4	12	14
Rinorea angustifolia												25							
Rothmannia globosa												25							
Rubus sp.									100	33	14								3
Ruttya ovata		4	5							11			83		18				
Salix mucronata						33													
Sarcostemma viminale		1											17	20	9				
Sartidia sp.																	8	2	5
Schefflera umbellifera										22		100							
Schizachyrium sanguineum		23		33									17				50	29	29
Schrebera alata		1	5							11			33		9		8	1	2
Sclerocarya birrea	20	26	47										17		18		4		
Sclerochiton harveyanus												25							
Scolopia zeyheri		5	16			17					29				27	100			
Securinega virosa	3		5			17							17						
Senecio sp.		1											17						
Sesbania sesban	6					50													
Setaria																			
cf. *megaphylla*		11	11	33						11			33	80	18				3
megaphylla	3					17				56		25			9				2
sphacelata	3	43	5		17		25								18		29	17	45
Solanum																			
rigescens																			2
aculeastrum									100										
sp.	3																		
Sorghum sp.	3																		
Species *Stalmans 2887* (cf. *Panicum* sp.)		12	5	67															3
Spirostachys africana													33						
Sporobolus																			
africanus	17	2	5		17	17	38		100					20			4	1	3
centrifugus		11															4	8	2
pectinatus		4															17	18	3
pyramidalis/fimbriatus	29	1			17	17	13	100											2
stapfianus	3	20	32											20			4		
Steganotaenia araliaceae													50		9				
Strelitzia caudata												25							
Strychnos																			
madagascariensis		9											17						
spinosa		5		33															
Suregada africana										11									
Syzygium																			
cordatum					17					56				20	9		8	4	3
gerrardii										11	14	100			9				

APPENDIX.—Synoptic table with constancy values (%) for all species in 19 plant communities of the Songimvelo Game Reserve. Community numbers refer to text (communities 8, 9 and 16 are only represented by 1 sample plot each) (continued)

Species	Community number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Tarchonanthus																			
camphoratus													17						
trilobus														20	9			1	2
Tarenna barbertonensis												25			9				
Themeda triandra	9	71	58	67	33	33	88	100			14			40	55		75	89	97
Trachypogon spicatus		32		33													50	73	48
Tragus berteronianus	20	5	11																
Trema orientalis										22									
Tricalysia sp.										11	57	100			9				
Trichilia dregeana					17					11	14							1	
Trichocladus grandiflorus		30								11							4		2
Tricholaena monachme	3																		
Trichoneura grandiglumis		30								11							4		2
Trichopteryx dregeana					17					11	14							1	
Trimeria grandifolia										22	86	25			9				
Tristachya leucothrix	3	13					25										8	63	35
Urochloa mossambicensis	23		5																
Urvletrum agropyroides																	4	2	
Vangueria infausta		6	21					100		11	14		17	40	9		8		3
Vepris																			
reflexa/Oricia sp.												50							
undulata														20					
Vernonia																			
neocorymbosa																			2
stipulacea										33	29								2
Vitex sp.		1											17		9				
Xerophyta sp.		11	5	67													58	7	6
Ximenia caffra		6											17		9				
Xymalos monospora										11	43	100							
Zanthoxylum																			
capense		5				17				22	43	25	50	20	64				
davyii												50							
Ziziphus mucronata	17	9	11		17	50		100		11	14			40	27				6

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The presence of synaptic and chromosome disjunction mutants in *Cenchrus ciliaris* (Poaceae: Paniceae)

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Keywords: asynapsis, desynapsis, meiosis, precocious chromatid segregation, synaptic mutants

ABSTRACT

Synaptic mutants are present in *Cenchrus ciliaris* L. This species, due to the presence of linear bivalents and occasional trivalents and quadrivalents, is an intermediate desynaptic species. In addition, geographical distribution and environmental factors, such as high temperatures and low humidity, could also have had an influence on the desynapsis observed. The disjunction of chromosomes during anaphase I was mostly abnormal in this desynaptic species. Precocious disjunction of chromosomes into chromatids occurred during anaphase I. Due to the high incidence of this chromosome abnormality, a mutant gene, '*pc*', responsible for the disjunction of chromosomes, must be present. The absence of cytokinesis in one specimen indicates a recessive mutant gene, '*va*', to be active in this species.

INTRODUCTION

Meiosis is a complex process and includes cytogenetic features such as chromosome pairing, synaptonemal complex formation, recombination, chromosome segregation and the creation of gametic meiotic products. The precise sequence of meiosis is under the control of various genes (Golubovskaya 1979). These include premeiotic genes, '*as*' genes (controlling leptotene and zygotene), '*des*' genes (controlling the various stages from pachytene to metaphase I) and chromosomal disjunction or spindle genes (controlling meiotic stages from anaphase I through to the formation of tetrads) (Golubovskaya 1979). Mutations present in these genes drastically change the normal behaviour of chromosomes within a specimen or species. Reports of synaptic and male-sterility mutants predominate, whereas premeiotic and disjunction mutants are relatively rare (Singh 1993).

Synaptic mutants are common in the plant kingdom and were originally discovered in maize (2n = 20) (Beadle & McClintock 1928) and were observed in about 20 higher plant families, consisting of 50 genera and approximately 70 species (Koduru & Rao 1981). The majority of these taxa belong to the family Poaceae (Singh 1993).

Meiotic mutants have been mainly identified with the aid of cytogenetic studies, genetic evidence and pollen or ovule abortion. These mutants, which arise mostly spontaneously, may result from interspecific hybridisation or may be induced by mutagenesis (Singh 1993). The aim of this study was to determine whether meiotic mutants are present in *Cenchrus ciliaris* L.

MATERIALS AND METHODS

The specimens used are listed in Table 1. Voucher herbarium specimens are housed in the George Potts Herbarium, Department of Botany and Genetics, University of the Orange Free State, Bloemfontein (BLFU). Slides, suitable for meiotic studies, were prepared according to the methods described by Visser & Spies (1994). A minimum of 20 cells of each of the following stages were studied: metaphase I, anaphase I, and telophases I and II. The following were recorded when observed: chromosome configurations and the number of univalents (MI), laggards (AI) and micronuclei (TI and TII).

RESULTS AND DISCUSSION

Cytogenetic results were recorded for 76 specimens (Table 1). Polyploidy is common and includes three levels, namely tetraploid (n = 2x = 18; 82.9%), pentaploid (n = 5/2x = 45/2; 9.2%) and hexaploid (n = 3x = 27; 6.6%).

Cells in the diakinesis stage were seldom observed. Well-defined meiotic configurations during diakinesis were observed in one specimen only, *Spies 5655* (Figure 1A). The chromosomes were small and configurations consisting of more than one chromosome, were identified based on relative size (Figure 1A–D). The chromosomes were often not paired and were distributed as univalents in the cell (Figure 1A–D).

Meiotic behaviour of the various chromosome configurations observed, varied during metaphase I (Figure 2A–E). Bivalents and occasional trivalents or quadrivalents moved to the equatorial plate, whereas the univalents were mostly distributed in the cytoplasm (Figure 2A–E). The number of univalents observed during metaphase I, varied within the different microsporocytes in the same specimen. In *Spies 5230*, zero to 18 univalents were observed during metaphase I (Table 1). This was the highest number of univalents observed within a single cell of this species (Table 1). More than 95% of the univalents observed were two or multiples of two per cell (Visser *et al.* 1998a), indicating that they originate from incomplete pairing of a chromosome pair, rather than representing the odd non-pairing chromosome in multivalent formation.

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TABLE 1.—Meiotic chromosome behaviour of *Cenchrus ciliaris* specimens. The voucher numbers, their quarter degree grid references, gametic chromosome numbers and meiotic chromosome behaviour are indicated

Voucher number	Grid	Gametic chromosome number	% Metaphase I cells containing univalents	% Anaphase I cells with precocious chromatid segregation	% Anaphase I cells containing various numbers of chromosome with precocious chromatid segregation													
					1	2	3	4	5	6	7	8	9	10	11	12	13	15
Spies 5883	2627CA	17	62 (0–4)	50	10	10	20	10	-	-	-	-	-	-	-	-	-	-
Spies 5215	3224DD	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5226	3320DC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5229	3325CD	18	100 (1–3)	75	17	-	33	8	-	8	8	-	-	-	-	-	-	-
Spies 5230	3325CD	18	88.9 (0–18)	50	-	11	11	11	6	6	6	-	-	-	-	-	-	-
Spies 5231	3324DA	18	16.7 (0–2)	62.4	19	13	6	6	19	-	-	-	-	-	-	-	-	-
Spies 5232	3324BD	18	40 (0–10)	50	20	10	20	-	-	-	-	-	-	-	-	-	-	-
Spies 5236	3224DC	18	14.3 (0–4)	82	27	46	9	-	-	-	-	-	-	-	-	-	-	-
Spies 5237	3224DC	18	20 (0–2)	56	13	6	25	6	-	-	6	-	-	-	-	-	-	-
Spies 5240	3224BC	18	90 (0–8)	63.5	-	9	18	9	9	9	-	9	-	-	-	-	-	-
Spies 5487	3222BC	18	40 (0–2)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5488	3222BC	18	44.4 (0–2)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5489	3222BC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5508	2925AB	18	23 (0–4)	66	22	22	22	-	-	-	-	-	-	-	-	-	-	-
Spies 5509	2925AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5512	2925AA	18	25 (0–6)	36.4	-	-	-	-	9	18	9	-	-	-	-	-	-	-
Spies 5521	2822DA	18	30 (0–6)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5522	2724AB	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5525	2723BC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5527	2724AB	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5529	2624DC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5531	2624DC	18	83.3 (0–6)	18	-	9	-	-	9	-	-	-	-	-	-	-	-	-
Spies 5538	2725AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5539	2725AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5542	2725AA	18	37.5 (0–5)	44	-	-	44	-	-	-	-	-	-	-	-	-	-	-
Spies 5543	2725CB	18	100 (1–4)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5553	2825BB	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5574	2826CD	18	20 (0–1)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5575	2826CD	18	77.8 (0–4)	21.3	-	7	7	-	7	-	-	-	-	-	-	-	-	-
Spies 5576	2826CD	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5577	2826CD	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5584	3125BC	18	50 (0–8)	61	8	16	8	14	8	7	-	-	-	-	-	-	-	-
Spies 5585	3125BC	18	40 (0–2)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5586	3125BC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5587	3125DC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5591	3225DB	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5594	3225DB	18	*	56	14	14	-	14	14	-	-	-	-	-	-	-	-	-
Spies 5638	2826CD	18	57 (0–4)	75	-	25	25	-	25	-	-	-	-	-	-	-	-	-
Spies 5642	2926AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5643	2926AA	18	0	10	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Spies 5645	2528CC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5646	2628AB	18	57.1 (0–8)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5649	2727AC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5650	2727AC	18	64 (0–8)	20	-	-	-	10	10	-	-	-	-	-	-	-	-	-

* Insufficient number of meiocytes of the particular meiotic stage studied.

TABLE 1.—Meiotic chromosome behaviour of *Cenchrus ciliaris* specimens.The voucher numbers, their quarter degree grid references, gametic chromosome numbers and meiotic chromosome behaviour are indicated (cont.)

Voucher number	Grid	Gametic chromosome number	% Metaphase I cells containing univalents	% Anaphase I cells with precocious chromatid segregation	% Anaphase I cells containing various numbers of chromosome with precocious chromatid segregation													
					1	2	3	4	5	6	7	8	9	10	11	12	13	15
Spies 5652	2627CD	18	100 (1–4)	36	-	18	-	9	9	-	-	-	-	-	-	-	-	-
Spies 5653	2627CA	18	75 (0–4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5654	2627CA	18	66.6 (0–5)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5655	2626DD	18	33.3 (0–3)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5657	2726DA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5659	2726CD	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5660	2826BB	18	62.5 (0–4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5662	2826AA	18	60 (0–4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5664	2926AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5668	3125BC	18	62.5 (0–4)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5669	3125BC	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5670	3125BC	18	100 (2–4)	10	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Spies 5671	3125DC	18	20 (0–2)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5675	3225DB	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5676	3225DB	18	0	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5847	2926AA	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5848	2926AA	18	87.5 (0–4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5849	2826CD	18	50 (0–4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5850	2826CD	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venter 9286	2732CC	18	85.7 (0–4)	40	10	10	-	20	-	-	-	-	-	-	-	-	-	-
Du Preez 2758	2925AD	45/2	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5210	3224DD	45/2	100 (3–8)	100	-	-	-	-	-	-	83	-	17	-	-	-	-	-
Spies 5238	3224DC	45/2	100 (1–10)	100	-	-	-	-	-	-	-	9	36	-	9	9	18	18
Spies 5239	3224DA	45/2	*	100	-	-	-	-	-	25	-	25	-	25	-	25	-	-
Spies 5497	2522DB	45/2	100 (2–8)	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spies 5581	3024DA	45/2	*	100	-	-	-	-	-	-	17	8	-	8	8	8	25	25
Spies 5583	3024DA	45/2	*	100	-	-	-	-	9	-	-	18	18	-	27	27	-	-
Spies 5510	2824DA	27	100 (2–7)	66	11	22	11	-	-	11	-	11	-	-	-	-	-	-
Spies 5513	2824DA	27	*	39	13	-	13	13	-	-	-	-	-	-	-	-	-	-
Spies 5514	2824DA	27	67 (0–8)	73	-	9	-	9	9	18	9	9	9	-	-	-	-	-
Spies 5515	2824DA	27	63 (0–5)	30	-	-	30	-	-	-	-	-	-	-	-	-	-	-
Spies 5517	2824DA	27	67 (0–3)	66	11	-	11	22	-	-	11	-	-	11	-	-	-	-

* Insufficient number of meiocytes of the particular meiotic stage studied.

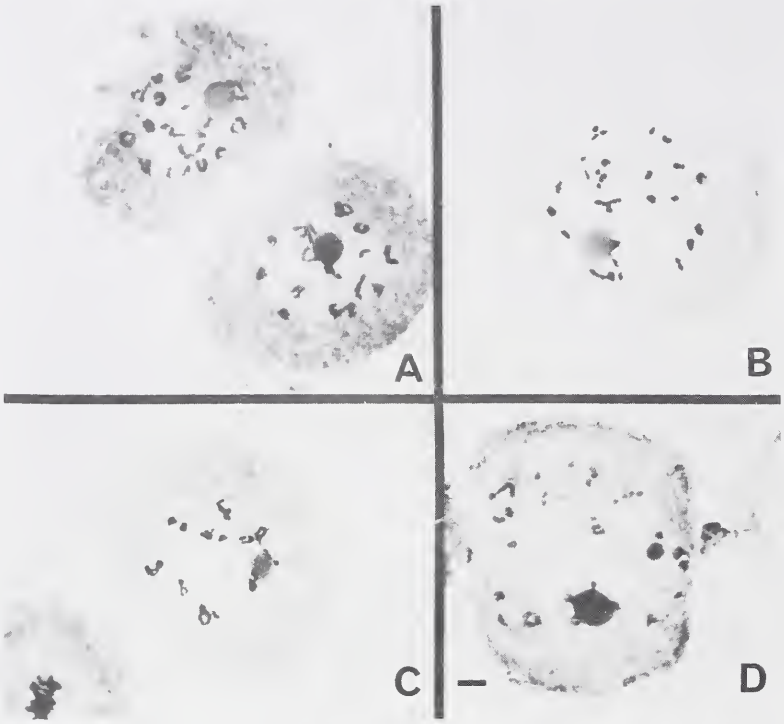

FIGURE 1.—Photomicrographs of *Cenchrus ciliaris* meiocytes during diakinesis, indicating the lack of well-defined meiotic configurations and the presence of univalents. A, *Spies 5655*, n = 18; B, *Spies 5574*, n = 18; C, *Spies 5583*, n = 45/2; D, *Spies 5517*, n = 27. Scale bar: 10 µm.

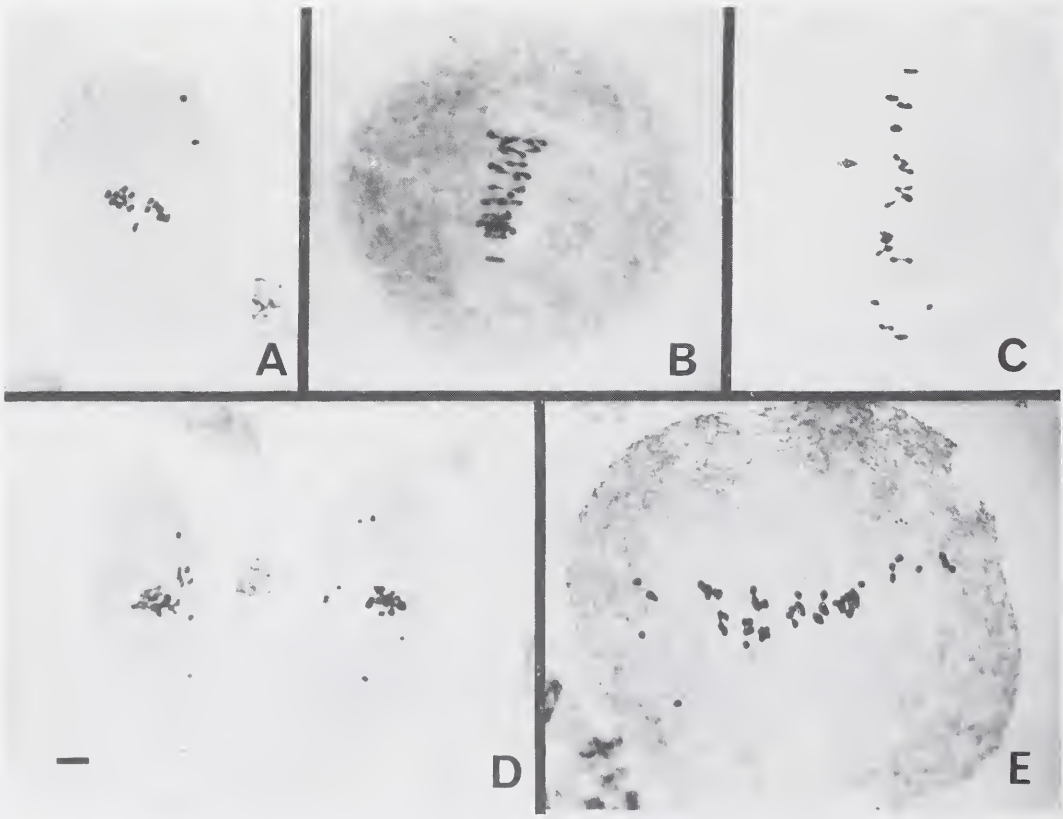

FIGURE 2.—Variation in number of univalents observed during metaphase I and II in *Cenchrus ciliaris*. A, *Spies 5883*, n = 17, two univalents; B, *Spies 5508*, n = 2x = 18, one univalent. C, *Spies 5543*, n = 2x = 18, two univalents; D, *Spies 5210*, n = 5/2x = 45/2, five univalents in each cell; E, *Spies 5514*, n = 3x = 27, eight univalents. Scale bar: 10 µm.

Chromosome pairing during prophase plays a critical role in the sequence of meiotic events that follow. The success of chromosome pairing during the early stages of the first meiotic division, will affect the viability of the meiotic gametes formed. Incomplete chromosome pairing will lead to various meiotic irregularities, such as the formation of univalents, the presence of chromosome laggards and micronuclei.

The partial or complete loss of chromosome pairing observed during prophase and metaphase I can be attributed to one of two processes, namely asynapsis or desynapsis. Asynapsis (Randolph 1928) is the absence of chromosome pairing during the first meiotic division, whereas desynapsis (Li *et al.* 1945) is the failure to maintain association after first synapsis in prophase. The paired chromosomes, therefore, dissociate during diplotene. The action of asynaptic genes is recognisable when most, or all of the chromosomes, remain as univalents at diakinesis and metaphase I. These genes also induce polyploid meiocytes, elongated and curved spindles, and the misdivision of univalents (Miller 1963). Beadle (1930) assigned the gene symbol '*as*' to these types of mutants.

Prakken (1943) classified desynaptic mutants, depending upon their expressivity, into three categories, namely weakly desynaptic (several univalents), intermediate desynaptic (many univalents) and completely desynaptic (exclusively univalents and rarely any bivalents). The cytogenetic results of this study indicate the presence of desynaptic genes. Univalents observed during diplotene and metaphase I were accompanied by bivalents and occasionally quadrivalents (Figure 2C). Not all of the chromosomes present were univalents (Figure 2B, C, E). *Cenchrus ciliaris* is thus an intermediate desynaptic species.

The variation in the number of univalents present in the cells, excludes the presence of asynaptic genes, since asynapsis is associated with complete lack of chromosome pairing. The variation in the number of univalents also varied among the cells of a particular specimen, and among specimens belonging to the same polyploid level. This suggests that within the chromosome complement of a species, there may be differences among the different chromosomes concerning their requirements for the initiation of pairing (Rees 1958; Swaminathan & Murty 1959; Koduru & Rao 1981). Since chiasmata in desynaptic mutant plants are mostly terminal and rarely interstitial at metaphase I (Li *et al.* 1945), the number of rod and ring bivalents were noted particularly during metaphase I. Most of the bivalents observed within the specimens of all three polyploid levels, were linear (Figure 2B, C, E), indicating terminal chiasmata. This observation confirmed the presence of synaptic mutants in this species.

Previous studies indicated that *C. ciliaris* forms an agamic complex and all ploidy levels represent specimens which are alloploid or segmental alloploid tending towards alloploidy (References listed in Visser *et al.* 1998a, b, c). These specimens are consequently supposed to behave meiotically almost as diploids. Although the very low frequency of multivalents formed in a few specimens could contribute to the formation of univalents, we regard that contribution as insignificantly low and consider the majority of univalents in this study as the result of desynaptic genes.

Spontaneous synaptic mutants exhibit monogenic recessive inheritance mostly (Koduru & Rao 1981) and have been isolated from natural populations. The majority of synaptic mutants reported in the higher plants have been identified in diploid species, such as *Hordeum vulgare* L. (Ramage 1985). Fifteen desynaptic genes have been identified in barley, of which 13 were of spontaneous origin and two were induced (Hernandez-Soriano *et al.* 1973; Hernandez-Soriano & Ramage 1974, 1975).

Chromosome behaviour during anaphase I differed among the various specimens studied. Univalents lying away from the spindle equator during metaphase I, were randomly distributed as laggards to the poles during anaphase I. Univalents distributed on the metaphase plate orientated themselves axially and divided into chromatids, which in turn lagged during segregation to opposite poles during anaphase I (Figure 3A–I). This precocious disjunction of chromosomes into chromatids during anaphase I, was observed in 24 of the specimens studied (Table 1). These specimens represented all three polyploid levels (Figure 3A–I) (Table 1). The number of chromosomes participating in the precocious disjunction varied from one to a maximum of 15 (Table 1).

The premature segregation of some univalents into chromatids resulted, in the case of a tetraploid specimen ($n = 2x = 18$) with two univalents, in a 20/20 distribution of chromosomes and chromatids during late anaphase I. In a normal cell, an 18/18-chromosome distribution is expected. The segregating chromatids were, due to their smaller size, distinguished from the normal chromosomes (Figure 3A–E). The segregating chromosomes were organised into dyad nuclei, whereas the chromosome and/or chromatid laggards were included in micronuclei.

Temperature, humidity and chemicals (Prakken 1943; Ahloowalia 1969; Koduru & Rao 1981) may influence the degree of chromosome pairing in synaptic mutants. It also varies from plant to plant, day to day, year to year and between specimens collected at different times during the same day (Prakken 1943; Soost 1951). The degree of expression of each synaptic gene is also variable. Goodspeed & Avery (1939) reported, with regard to an asynaptic mutant of *Nicotiana sylvestris* L., that high temperature and low humidity greatly increased asynapsis, whereas high temperatures and high humidity decreased asynapsis. Ahloowalia (1969) recorded, in a desynaptic mutant of *Hordeum vulgare* ($2n = 14$), that at lower temperatures (11°C), the mean number of bivalents/cell was 7.71, but that at 28°C, the mean number of bivalents dropped to 5.39 bivalents/cell due to desynapsis. In contrast, Li *et al.* (1945) observed a greater degree of pairing at higher temperatures and decreased pairing at lower temperatures in desynaptic mutants of *Triticum aestivum* L.

The *Cenchrus ciliaris* specimens studied, were collected in areas with a very low average annual rainfall.

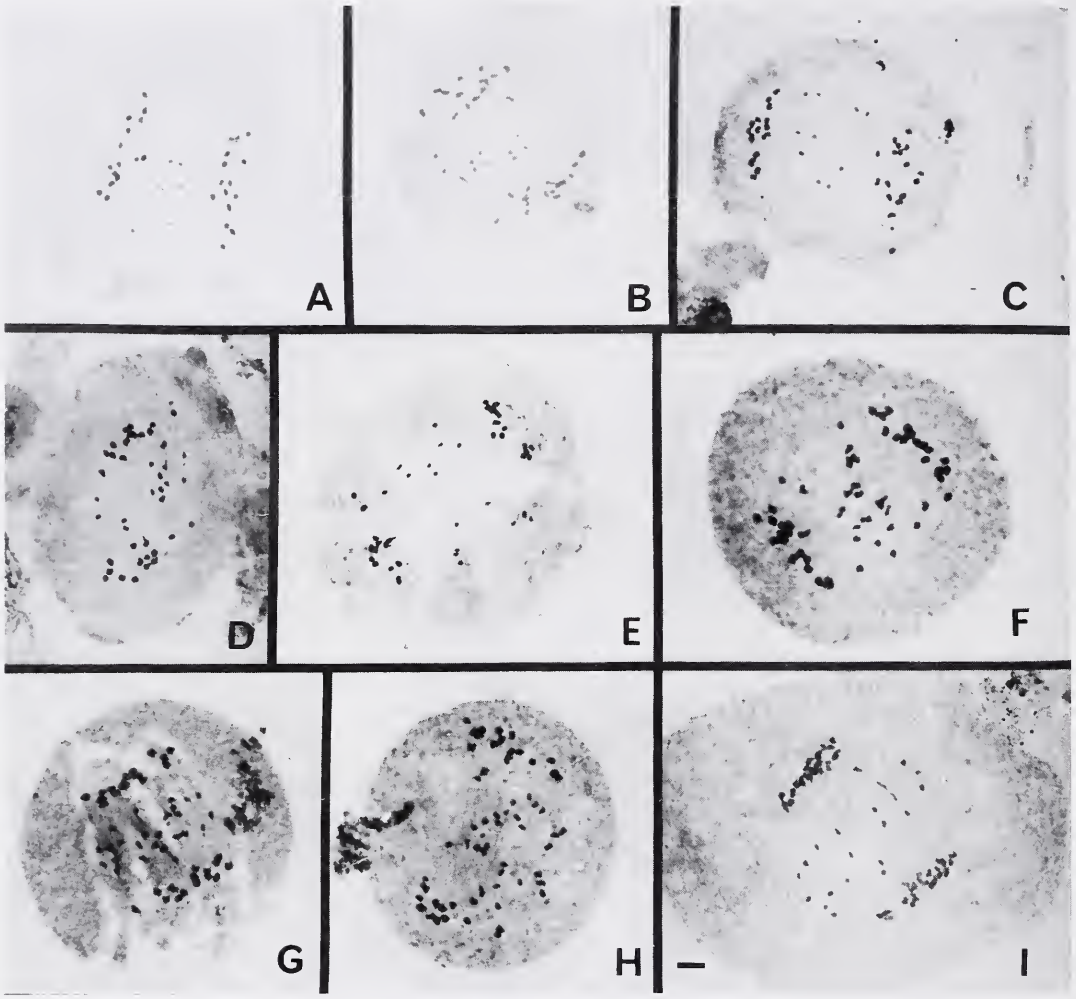

FIGURE 3.—Variation in the number of chromosomes undergoing precocious disjunction during anaphase I in *Cenchrus ciliaris*. A, *Spies 5531* & B, *Spies 5512*, n = 2x = 18, 15-15 chromosome distribution, with six chromosome laggards segregating into chromatids; C, *Spies 5230*, n = 2x = 18, 15-16 chromosome distribution, with five laggards segregating into chromatids; D, *Spies 5231*, n = 2x = 18, 14-14 chromosome distribution, with three segregating laggards; E, *Spies 5240*, n = 2x = 18, 13–15 chromosome distribution, with eight laggards; F, *Spies 5583*, n = 5/2x = 45/2, 16-17 chromosome distribution, with approximately nine laggards; G, H, *Spies 5581*, n = 5/2x = 45/2, various chromosomes and chromatids lagging; I, *Spies 5517*, n = 3x = 27, with a minimum of nine laggards segregating into chromatids during anaphase I. Scale bar: 10 µm.

These areas represent some of the hottest and least humid geographical regions in South Africa. Therefore, the geographical distribution and environmental factors could also have had an influence on the desynapsis observed within specimens belonging to this species.

The disjunction of the chromosomes during anaphase I in *C. ciliaris* was not normal according to the description of meiotic behaviour for desynaptic mutants previously mentioned. Very few chromosome laggards observed during anaphase I, did not undergo disjunction into chromatids (Figure 3A–E). This chromosome abnormality was representative of all three polyploid levels and was observed in 47.7% of all the specimens studied (Table 1). The high percentage of precocious disjunction suggests the presence of a mutated gene responsible for the disjunction of chromosomes.

A meiotic mutant that shows precocious centromere division, '*pc*', in *Lycopersicon esculentum* Mill. was described by Clayberg (1959). Chromosome pairing was normal until metaphase I. The precocity first appeared at anaphase I in some bivalents that often lagged and underwent premature centromere division. The centromeres of those chromosomes not lagging during the first division, divided mostly during prophase II. All of these chromosomes were regularly oriented on the metaphase II plate. The precociously divided chromosomes moved at random to the poles without further division. Many chromosomes lagged in the second division and frequently formed restitution nuclei. The mutation segregates as a single recessive gene, '*pc*'.

Although in *Cenchrus ciliaris* the situation differs to some extent, chromosome pairing was mostly normal

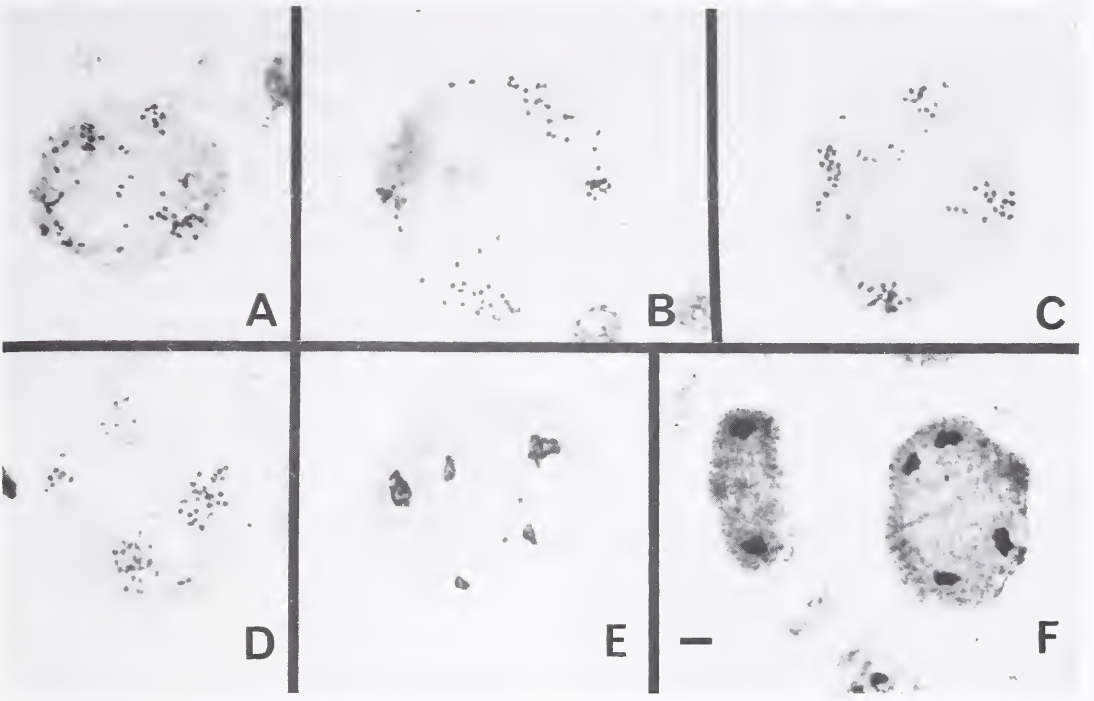

FIGURE 4.—Absence of cytokinesis in *Spies 5512*, resulting in four-nucleated cells. A, anaphase I, ~65 chromosomes; B, anaphase I, ~70 chromosomes; C, anaphase I, ~66 chromosomes; D, anaphase I, ~68 chromosomes; E, telophase I, one nucleus in each pole, with three micronuclei; F, telophase II, normal-sized telophase II cell, with abnormal telophase II cell (four nuclei and one micronucleus). Scale bar: 10 µm.

until metaphase I. The precocity first appeared at anaphase I in some chromosomes that lagged and underwent premature centromere division. The presence of a gene responsible for precocious centromere division, could, therefore, also be functional in this species.

One specimen, *Spies 5512* (n = 2x = 18), exhibited normal chromosome behaviour until telophase I, but cytokinesis did not occur in some of the meiocytes studied (Figure 4A–F). Two spindles formed in some of the cells, resulting in four anaphase I poles (Figure 4A–D). This resulted in cells containing a total of approximately 62 to 69 chromosomes, being distributed amongst the four poles during anaphase I. The lack of cytokinesis resulted in gametes with unequal chromosome constitutions. Chromosomes not segregating to the nearest pole were excluded from the main nuclei, and included in additional micronuclei (Figure 4E, F). Another chromosome disjunction mutant, namely the recessive mutant '*va*', may be active in this specimen. Beadle (1932) first identified this mutant in maize. He based his hypothesis on the fact that a homozygous plant (*va/va*) exhibited a normal prophase I, but cytokinesis was absent during telophase I. This resulted in gametes with diploid and tetraploid chromosome constitutions (Singh 1993). Beadle (1932) stated that failure of cytokinesis might either occur at the first or the second meiotic division. Due to the lack of cytokinesis, an increase in chromosome numbers can occur. This mutant gene could, therefore, be the reason for higher polyploid levels within this species.

Due to the lack of cytokinesis in some of the cells belonging to this specimen, the disjunction gene, '*va*', may be present. Since this specimen was collected near the only hexaploid (n = 3x = 27) specimens studied (*Spies 5514, 5515 & 5517*), this mutated gene could have been responsible for the high polyploid levels in this area.

CONCLUSIONS

The cytogenetic results indicate the presence of synaptic mutants in *C. ciliaris*. This statement is based on incomplete chromosome pairing, which led to the origin of various chromosome irregularities observed during meiosis. This species was characterised as an intermediate desynaptic species. Geographical distribution and environmental factors, such as high temperatures and low humidity, could also have had an additional influence on the desynapsis observed in this species.

The disjunction of chromosomes during anaphase I was mostly abnormal in this desynaptic species. Precocious disjunction of chromosomes during anaphase I led to the formation of chromatids. Due to the high incidence of this chromosome abnormality, a mutant gene, '*pc*', responsible for the disjunction of chromosomes, may be present. The lack of cytokinesis in one specimen indicates the possible presence of a recessive mutant gene, '*va*' in this species.

It is, therefore, concluded that three meiotic mutant genes could be active in this species, namely the desynaptic mutant '*as*', active during prophase, and the two chromosome disjunction mutant genes '*pc*' and '*va*'.

ACKNOWLEDGEMENTS

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REFERENCES

AHLOOWALIA, B.S. 1969. Effect of temperature and barbiturates on a desynaptic mutant of ryegrass. *Mutation Research* 7: 205–213.

BEADLE, G.W. 1930. Genetical and cytological studies of Mendelian asynapsis in *Zea mays*. *Cornell University Agricultural Experiment Station Memoirs* 129: 1–23.

BEADLE, G.W. 1932. A gene in *Zea mays* for failure of cytokinesis during meiosis. *Cytologia* 3: 142–155.

BEADLE, G.W. & MCCLINTOCK, B. 1928. A genic disturbance of meiosis in *Zea mays*. *Science* 68: 433.

CLAYBERG, C.D. 1959. Cytogenetic studies of precocious meiotic centromere division in *Lycopersicon esculentum* Mill. *Genetics* 44: 1335–1346.

GOLUBOVSKAYA, I.N. 1979. Genetic control of meiosis. *International Review of Cytology* 58: 247–290.

GOODSPEED, T.H. & AVERY, P. 1939. Trisomic and other types in *Nicotiana sylvestris*. *Journal of Genetics* 38: 381–458.

HERNANDEZ-SORIANO, J.M. & RAMAGE, R.T. 1974. Normal versus desynapsis. *Barley Genetics Newsletter* 4: 137–142.

HERNANDEZ-SORIANO, J.M. & RAMAGE, R.T. 1975. Normal versus desynapsis. *Barley Genetics Newsletter* 5: 113.

HERNANDEZ-SORIANO, J.M., RAMAGE, R.T. & ESLICK, R.F. 1973. Normal versus desynapsis. *Barley Genetics Newsletter* 3: 124–131.

KODURU, P.R.K. & RAO, M.K. 1981. Cytogenetics of synaptic mutants in higher plants. *Theoretical and Applied Genetics* 59: 197–214.

LI, H.W., PAO, W.K. & LI, C.H. 1945. Desynapsis in common wheat. *American Journal of Botany* 32: 92–101.

MILLER, O.L. 1963. Cytological studies in asynaptic maize. *Genetics* 48: 1445–1466.

PRAKKEN, R. 1943. Studies of asynapsis in rye. *Hereditas* 29: 475–495.

RAMAGE, R.T. 1985. Cytogenetics in barley. *Agronomy Monograph* No. 26: 127–154. American Society of Agronomy/Crop Science Society of America/Soil Science Society of America, Madison.

RANDOLPH, L.F. 1928. Chromosome numbers in *Zea mays* L. *Cornell University Agricultural Experiment Station Memoirs* 117: 1–44.

REES, H. 1958. Differential behaviour of chromosomes in *Scilla*. *Chromosoma* 9: 185–192.

SINGH, R.J. 1993. *Plant cytogenetics*. CRC Press, London.

SOOST, R.K. 1951. Comparative cytology and genetics of asynaptic mutants in *Lycopersicon esculentum* Mill. *Genetics* 36: 410–434.

SWAMINATHAN, M.S. & MURTY, B.R. 1959. Aspects of asynapsis in plants. I. Random and non-random chromosome associations. *Genetics* 44: 1271–1280

VISSER, N.C. & SPIES, J.J. 1994. Cytogenetic studies in the genus *Tribolium* (Poaceae: Danthonieae). III. Section *Tribolium*. *South African Journal of Botany* 60: 31–39.

VISSER, N.C., SPIES, J.J. & VENTER, H.J.T. 1998a. Meiotic chromosome behaviour in *Cenchrus ciliaris* (Poaceae: Panicoideae). *Bothalia* 28: 83–90.

VISSER, N.C., SPIES, J.J. & VENTER, H.J.T. 1998b. Uneven segregation of chromosomes: a possible source for aneuploidy in *Cenchrus ciliaris* (Poaceae: Paniceae). *South African Journal of Botany* 64: 130–136.

VISSER, N.C., SPIES, J.J. & VENTER, H.J.T. 1998c. Aneuploidy in *Cenchrus ciliaris* (Poaceae, Panicoideae, Paniceae). *South African Journal of Botany* 64: 337–345.

Bothalia 29,2: 335–341 (1999)

Miscellaneous notes

POACEAE

CHROMOSOME STUDIES ON AFRICAN PLANTS. 12. THE TRIBES OF SUBFAMILY POOIDEAE

Our laboratories have presented various papers of cytogenetic data on chromosome numbers of South African representatives of the grass subfamily, Pooideae (Spies & Du Plessis 1986a, b, 1987a, b; Spies & Voges 1988; Spies *et al.* 1996a, b, 1997). In this paper chromosome numbers of specimens from the smaller tribes, as well as miscellaneous specimens that were not included in previous papers, are presented.

The aim of this study is to determine the chromosome numbers, polyploid levels and meiotic chromosome behaviour of some of the South African representatives of the Pooideae.

MATERIALS AND METHODS

For the purpose of this study, cytogenetic material of identical plants of a population was collected and fixed in the field (Table 1). Voucher specimens are housed in the Geo Potts Herbarium, Department of Botany and Genetics, University of the Orange Free State, Bloemfontein (BLFU) or in the National Herbarium, Pretoria (PRE).

Anthers were squashed in aceto-carmine and meiotically analysed (Spies *et al.* 1996a). Only gametic chromosome numbers are presented to conform to previous papers on chromosome numbers in this journal (Spies & Du Plessis 1986a). Due to the large number of chromosome number reports on some of the species included in this study, we refer to the chromosome atlas rather than to all the individual publications for a specific species.

RESULTS AND DISCUSSION

Forty-seven plants, representing 29 species and 16 genera were studied (Table 1).

Tribe Poeae

In *Catapodium rigidum* we found n = 2x = 14 (Figure 1A), which confirms previous reports of the presence of both diploid and tetraploid specimens in this species (Ornduff 1968; Fedorov 1969; Moore 1972, 1977; Goldblatt 1983, 1985; Goldblatt & Johnson 1994).

Poa binata was tetraploid (n = 2x = 14) and *P. pratensis* hexaploid (Figure 2B–D) (n = 3x = 21). Chromosome number reports on *P. pratensis* indicate a wide range of aneuploid chromosome numbers in this species (2n = 25–124) (Ornduff 1967; Fedorov 1969; Moore 1970, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1998).

A diploid chromosome number (Figure 2E, F) for *Puccinellia angusta*, confirms a previous report from our laboratory (Spies *et al.* 1997). A possible B-chromosome was present in both *P. angusta* specimens (Figure 2G). Specimens of the *Puccinellia* sp. were hexaploid (Figure 2H, I).

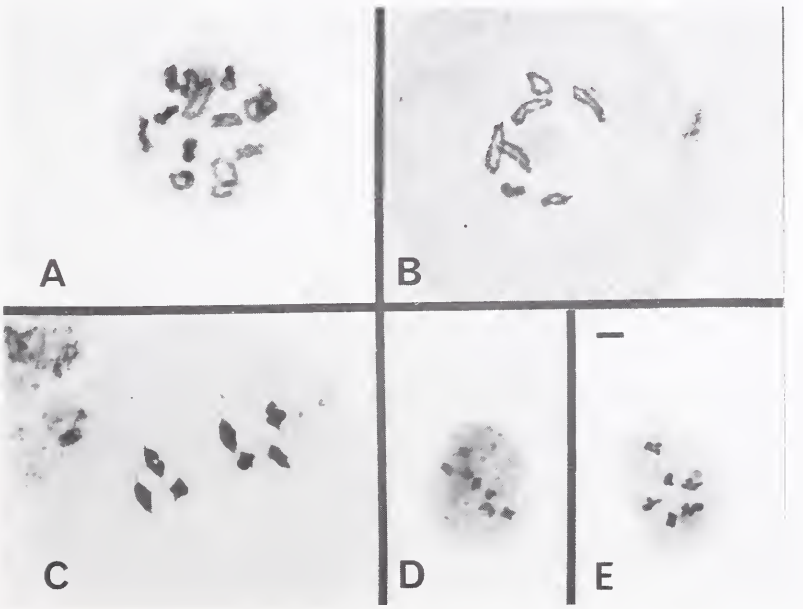

FIGURE 1.—Meiotic chromosomes in some specimens of the genera *Catapodium*, *Hainardia* and *Koeleria*. A, *Catapodium rigidum*, *Spies 4636*, n = 14, diakinesis with 14_{II}. B, C, *Hainardia cylindrica*, *Spies 5013*, n = 7: B, diakinesis; C, metaphase I, with 7_{II}. D, E, *Koeleria* sp., *Spies 5111*, n = 7: D, metaphase I; E, diakinesis, with 7_{II}. Scale bar: 6.5 µm.

TABLE 1.—Gametic chromosome numbers of representatives of the subfamily Pooideae (Poaceae) in southern Africa with their voucher specimen numbers and specific localities. Species are listed alphabetically and the localities are presented according to the system described by Edwards & Leistner (1971)

Taxon	Voucher	n	Locality and voucher no.
Tribe Poeae			
Catapodium rigidum (L.) C.E.Hubb.	*Spies 4636*	14	WESTERN CAPE.—3420 (Bredasdorp): 3 km north of De Hoop Nature Reserve, (–AD).
Lolium			
multiflorum Lam.	*Spies 5613*	7	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
	Spies 2468	7	EASTERN CAPE.—3126 (Queenstown): Penhoek Pass, (–BA).
rigidum Gaudin	*Spies 5358*	7	WESTERN CAPE.—3118 (Vanrhynsdorp): 21 km from Doringbaai to Donkins Bay, (–CD).
sp.	*Spies 5005*	7	WESTERN CAPE.—3218 (Clanwilliam): on beach, Lambert's Bay, (–AB).
Poa			
binata Nees	*Spies 4666*	14	EASTERN CAPE.—3028 (Matatiele): 10 km from Rhodes to Naude's Neck, (–CC).
pratensis L.	*Spies 4720*	28	EASTERN CAPE.—3027 (Lady Grey): 30 km from Rhodes to Lundean's Neck, (–DD).
	Spies 4670	28	EASTERN CAPE.—3028 (Matatiele): 12 km from Rhodes to Naude's Neck, (–CC).
Puccinellia			
angusta (Nees) Smith & C.E.Hubb.	*Spies 3157a*	7+0–1B	NORTHERN CAPE.—2917 (Springbok): 17 km from Steinkopf to Port Nolloth, (–BD).
	Spies 3773	7+0–1B	WESTERN CAPE.—3319 (Worcester): Katbakkies turnoff, on road between Ceres and Citrusdal, (–AB).
sp.	*Spies 3364*	21	NORTHERN CAPE.—2917 (Springbok): 6 km from Kleinsee to Springbok, (–CA).
	Spies 3069	21	NORTHERN CAPE.—3018 (Kamiesberg): eastern side of Kamiesberg, (–AC).
Vulpia			
muralis (Kunth) Nees	*Spies 4309*	21	WESTERN CAPE.—3318 (Cape Town): 7 km from Yzerfontein to Darling, (–AC).
myuros (L.) S.F.Gray	*Spies 3112*	7+0–1B	WESTERN CAPE.—3017 (Hondeklipbaai): dunes at Groenrivier Mouth, (–DC).
Tribe Hainardieae			
Hainardia cylindrica (Willd.) Greuter	*Spies 5013*	7	WESTERN CAPE.—3318 (Cape Town): 2 km east of Mamre Road, (–BC).
Parapholis incurva (L.) C.E.Hubb.	*Spies 5006*	21	WESTERN CAPE.—3218 (Clanwilliam): on beach, Lambert's Bay, (–AB).
Tribe Meliceae			
Melica			
decumbens Thunb.	*Spies 4802*	9	FREE STATE.—2827 (Senekal): 6 km from Clocolan to Peka Bridge, (–DC).
	Spies 4762	9	EASTERN CAPE.—3027 (Lady Grey): 82 km from Barkly East to Lady Grey, via Joubert's Pass, (–CD).
	Spies 5221	9	EASTERN CAPE.—3323 (Willowmore): 168 km from Patensie to Willowmore, (–DA).
racemosa Thunb.	*Spies 4777*	9	FREE STATE.—2926 (Bloemfontein): 19 km from Dewetsdorp to Hobhouse, (–DB).
	Spies 5197	9	EASTERN CAPE.—3324 (Steytlerville): 25 km from Patensie to Willowmore, (–DA).
sp.	*Spies 4538*	9	WESTERN CAPE.—3420 (Bredasdorp): 30 km from Bredasdorp to Swellendam, (–CA).
Tribe Aveneae			
Agrostis sp.	*Spies 4308a*	14	NORTHERN CAPE.—3017 (Hondeklipbaai): 18 km from Kamieskroon to Leliefontein, (–BA).
Avena sativa L.	*Spies 5611*	21	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
Koeleria sp.	*Spies 5111*	7	MPUMALANGA.—2530 (Lydenburg): 5 km from Belfast to Dullstroom, (–CA).
Tribe Bromeae			
Bromus			
catharticus Vahl	*Spies 4760*	21	EASTERN CAPE.—3027 (Lady Grey): 82 km from Barkly East to Lady Grey via Joubert's Pass, (–CD).
	Spies 2505	21	EASTERN CAPE.—3027 (Lady Grey): Beestekraal, (–DC).
	Spies 4668	21	EASTERN CAPE.—3028 (Matatiele): 10 km from Rhodes in Naude's Neck, (–CC).
	Spies 4673	21	EASTERN CAPE.—3028 (Matatiele): 12 km from Rhodes on Naude's Neck, (–CC).
pectinatus Thunb.	*Spies 4280*	14	NORTHERN CAPE.—2917 (Springbok): 17 km from Springbok to Hondeklipbaai, (–DB).
rigidus Roth	*Spies 5300*	28	WESTERN CAPE.—3119 (Calvinia): 7 km from Nieuwoudtville to Clanwilliam, (–AC).
sp.	*Spies 4816*	21	FREE STATE.—2827 (Senekal): 29 km from Clocolan to Ficksburg, (–DC).
Tribe Triticeae			
Hordeum murinum	*Spies 4977*	7	WESTERN CAPE.—3319 (Worcester): 1 km south of old toll house in Mitchell's Pass, (–AD).
subsp. *murinum*	*Spies 3385*	14	WESTERN CAPE.—3418 (Simonstown): Redhill, (–AB).
subsp. *leporinum*	*Spies 4939*	7	MPUMALANGA.—2530 (Lydenburg): 18 km from Lydenburg to Weltevreden, (–AB).
	Spies 4949	7	MPUMALANGA.—2530 (Lydenburg): 6 km from Dullstroom to Goede Hoop, (–AC).
	Spies 5003	7	EASTERN CAPE.—3028 (Matatiele): 47 km from Rhodes in Naude's Neck, (–CC).
	Spies 4925	7	EASTERN CAPE.—3228 (Butterworth): on beach at Bonza Bay, (–CC).
vulgare L. subsp. *vulgare*	*Spies 5612*	14	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
Secale			
africanum Stapf	*Spies 5608*	7	NORTHERN CAPE.—3220 (Sutherland): near Sutherland, (–BC).
cereale Bieb.	*Spies 5607*	7	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
Triticum aestivum L.			
Karee	*Spies 5606*	21	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
Tugela	*Spies 5604*	21	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
Zarragossa	*Spies 5603*	21	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
durum Desf.	*Spies 5605*	14	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).
× *Triticosecale* Wittm.	*Spies 5609, 5610*	21	FREE STATE.—2926 (Bloemfontein): cultivated, UOFS campus, (–AA).

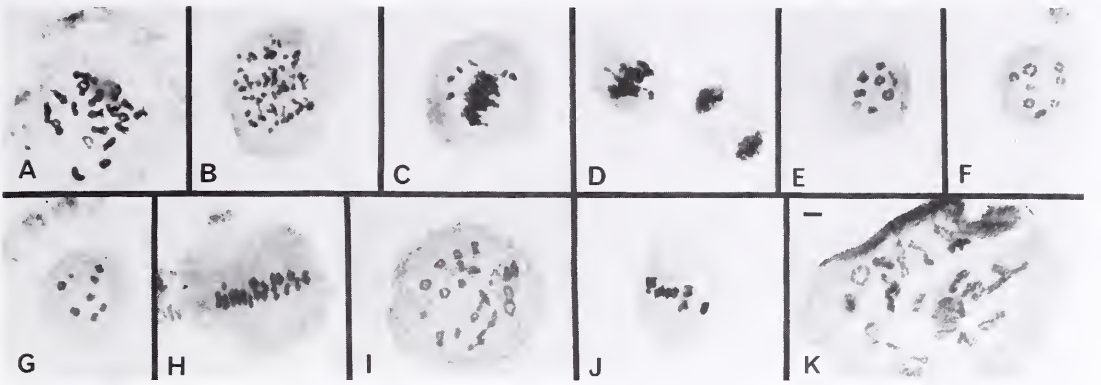

FIGURE 2.—Meiotic chromosomes. A, *Parapholis incurva*, *Spies 5006*, n = 21, diakinesis with 21_{II}; B, *Poa pratensis*, *Spies 4670*, n = 28, early anaphase I; C, D, *Spies 4720*, metaphase I cells with univalents; E, F, *Puccinelia angusta*, *Spies 3157a*, *3773*, n = 7, diakinesis with 7_{II}; G, n = 7+1B, diakinesis with 7_{II} 1_{I} — the univalent is probably a B-chromosome. H, I, *Puccinellia* sp.: H, *Spies 3069*, n = 21, metaphase I with 21_{II}; I, *Spies 3364*, n = 21+0–4B, diakinesis with 21_{II} and 3–4 B-chromosomes; J, *Vulpia myuros*, *Spies 3112*, n = 7+1B, metaphase I with 7_{II} and a B-chromosome; K, *V. muralis*, *Spies 4309*, n = 21, diakinesis with 21_{II}. Scale bar: 6.5 µm.

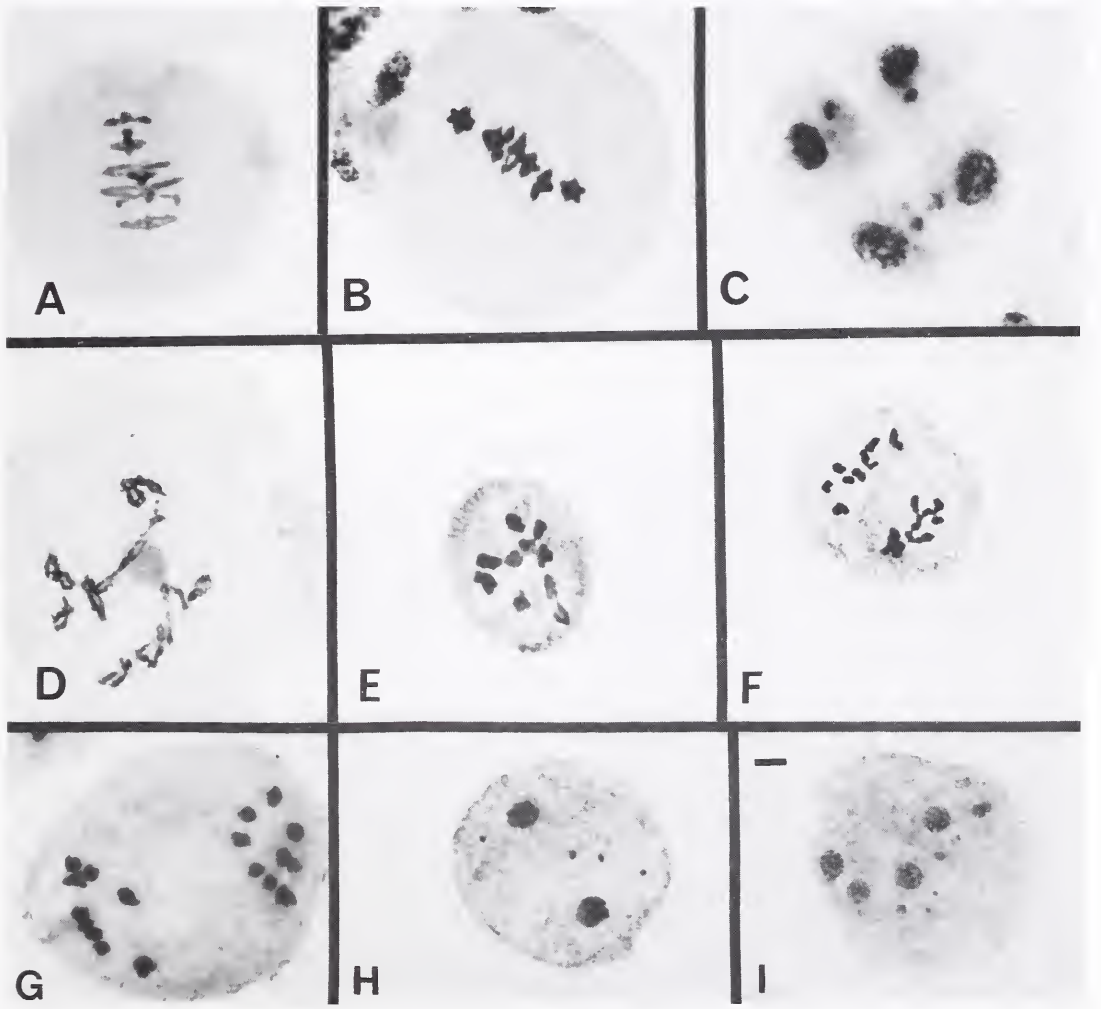

FIGURE 3.—Meiotic chromosomes. A, C, *Lolium rigidum*, *Spies 5358*: A, n = 7, metaphase I with 7_{II}; C, telophase II with micronuclei in all cells of tetrad. B, *Lolium* sp., *Spies 5005*, n = 7, metaphase I with 7_{II}. D, E, *Melica decumbens*: D, *Spies 5221*, n = 9, diplotene with 9_{II}; E, *Spies 4802*, n = 9, diakinesis with 9_{II}. F, G, *M. racemosa*, n = 9, anaphase I with 9-9 chromosome segregation: F, *Spies 5197*; G, *Spies 4777*. H, I, *Melica* sp., *Spies 4583*: H, telophase I with four micronuclei; I, telophase II with various micronuclei and no cytokinesis. Scale bar: A–H, 6.5 µm; I, 27.3 µm.

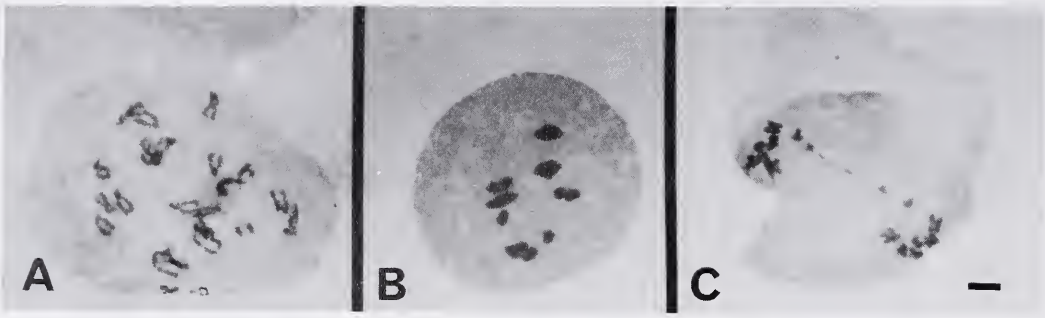

FIGURE 4.—Meiotic chromosomes in some specimens of the genera *Avena* and *Lolium*. A, *Avena sativa*, *Spies 5611*, n = 21, diakinesis with 21_{II}; B, C, *Lolium multiflorum*, *Spies 5613*, n = 7+0–2B: B, early metaphase I with 7_{II} and two unpaired B-chromosomes; C, anaphase I with a bridge. Scale bar: A, 27.3 µm; B, C, 6.5 µm.

Vulpia myuros was diploid (Figure 2J, K), thus confirming various previous results which stated that diploid, tetraploid and hexaploid specimens had been observed (Ornduff 1967, 1968; Fedorov 1969; Moore 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996).

Diploid chromosome numbers (n = x = 7) were observed for all the *Lolium* specimens studied (Figure 3A–C). These observations for *L. multiflorum*, *L. rigidum* and *Lolium* sp. confirm previous results (Ornduff 1968; Fedorov 1969; Moore 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998). Some metaphase I cells contained univalents (Figure 4B) and an anaphase 1 bridge was observed (Figure 4C).

Tribe Hainardieae

An interesting observation during this study is the diploid chromosome number of n = x = 7 for *Hainardia cylindrica* (Figure 1B, C). The literature indicates a basic chromosome number of x = 13 (Goldblatt 1981; Goldblatt & Johnson 1994). Further studies of this rare representative of the tribe Hainardieae are needed to determine whether the South African representative deviates in other aspects from its Mediterranean counterparts.

The hexaploid *Parapholis incurva* specimen (Figure 2A) confirms previous reports on this species (Fedorov 1969; Goldblatt 1981, 1983). However, another ploidy level (2n = 28), including aneuploidy (2n = 24, 36 & 38), has also been reported (Fedorov 1969; Moore 1972,

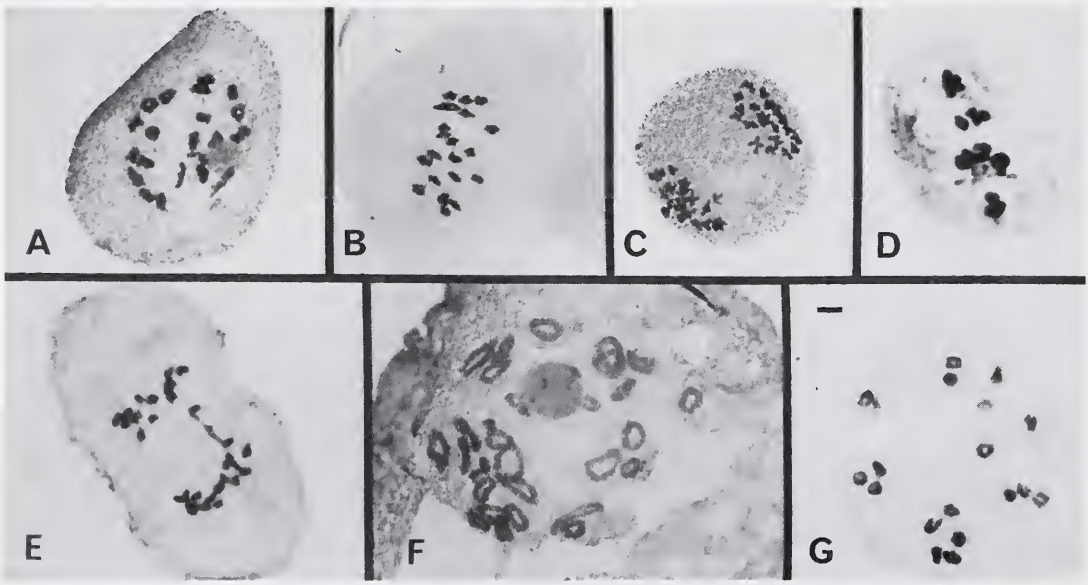

FIGURE 5.—Meiotic chromosomes in specimens of genus *Bromus*. A–C, *B. catharticus*: A, C, *Spies 2505*; B, *Spies 4668*, n = 21. A, diakinesis with 21_{II}; B, metaphase I with 21_{II}; C, anaphase I with 21-21 segregation of chromosomes. D, E, *B. pectinatus*, *Spies 4280*, n = 14: D, metaphase I; E, anaphase I, with one chromosome segregating late. F, *B. rigidus*, *Spies 5300*, n = 28, diakinesis with 28_{II}; G, *Bromus* sp., *Spies 4816*, n = 21, diakinesis with 21_{II} (3_{II} are out of focus). Scale bar: 6.5 µm.

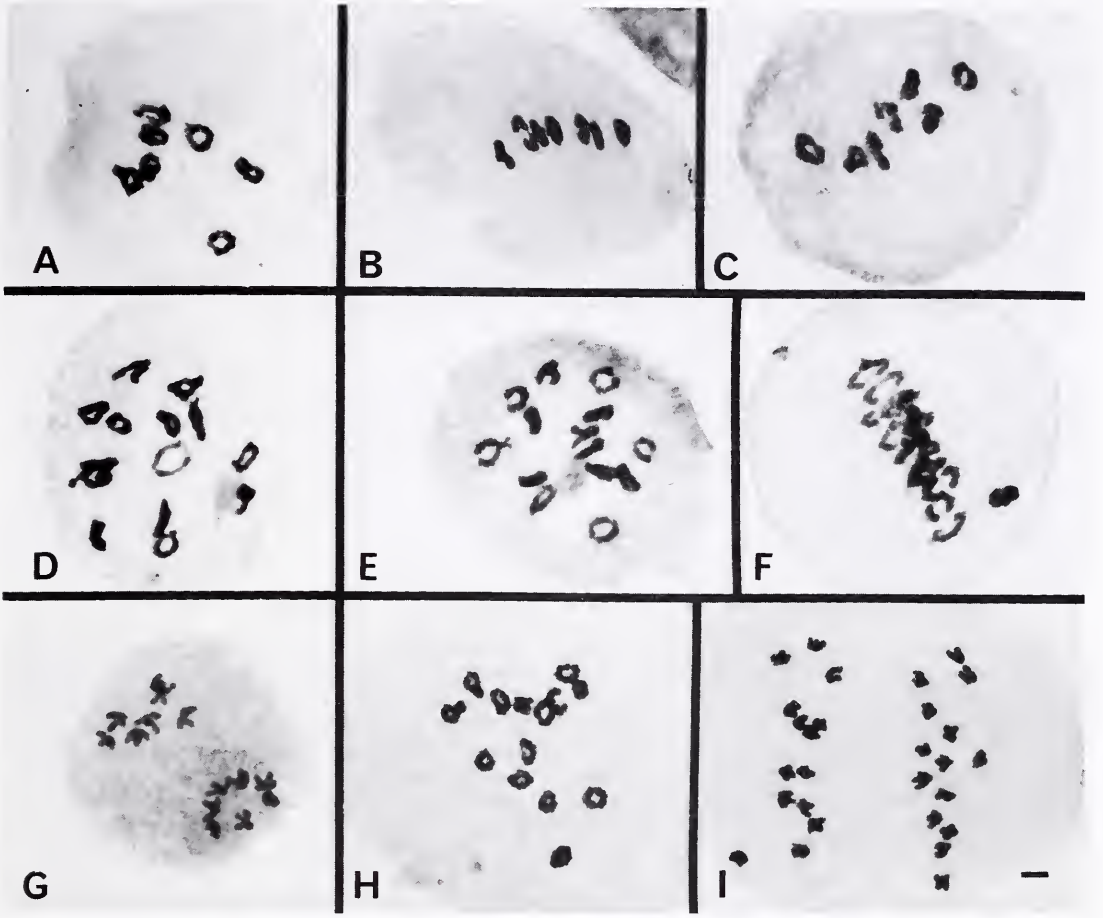

FIGURE 6.—Meiotic chromosomes in specimens of genus *Hordeum*. A, B, *H. murinum*, *Spies 4977*, n = 7: A, diakinesis with 7_{II}; B, metaphase I with 7_{II}. C–G, *H. murinum*: C, subsp. *leporinum*, *Spies 4939*, n = 7, early metaphase I with 7_{II}; D–G, subsp. *murinum*, *Spies 3385*, n = 14: D, E, diakinesis with 14_{II}; F, metaphase I; G, anaphase I with a 7-7 segregation of chromosomes, indicating a cell with n = 7 in same individual. H, *H. vulgare* subsp. *vulgare*, *Spies 5612*, n = 14, diakinesis with 14_{II}; I, anaphase I with 14-14 segregation. Scale bar: 6.5 µm.

1977; Goldblatt 1981, 1983; Goldblatt & Johnson 1994, 1998).

Tribe Meliceae

Melica decumbens (Figure 3D, E), *M. racemosa* (Figure 3F, G) and *Melica* sp. have basic chromosome numbers of nine, thus confirming previous reports (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998). Various meiotic abnormalities were observed during this study, particularly micronuclei during telophase 1 (Figure 3H, I).

Tribe Aveneae

In *Agrostis* sp. both the basic chromosome number of seven and the tetraploid level (n = 2x = 14) conform with previous reports on this genus (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998).

The specimen of *Koeleria* sp. was diploid, n = x = 7 (Figure 1D, E) with normal meiosis.

The hexaploid chromosome number observed for *Avena sativa* (Figure 1A) conforms with numerous reports on this species (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998). Only bivalents were formed and meiosis was normal.

Tribe Bromeae

The genus *Bromus* consists of 150 species worldwide (Clayton & Renvoize 1986), and 15 species are present in South Africa (Gibbs Russell *et al.* 1990). Three of these species were included in this study (Table 1), all specimens have x = 7 (Figure 5) and tetraploid to octaploid specimens were observed. The hexaploid (n = 3x = 21) counts for *B. catharticus* (Figure 5A–C) confirm

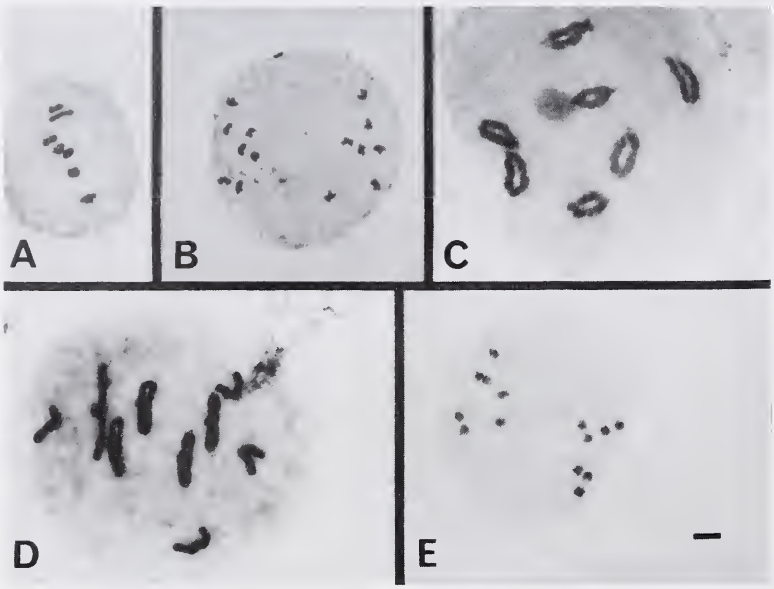

FIGURE 7.—Meiotic chromosomes in specimens of genus *Secale*. A, B, *S. africanum*, *Spies 5608*, n = 7: A, metaphase I with 7_{II}; B, anaphase I with a 7-7 segregation. C–E, *S. cereale*, *Spies 5607*, n = 7: C, diakinesis with 7_{II}; D, metaphase I with $5_{II}4_{I}$; E, anaphase I with a 7-7 segregation. Scale bar: A, B, E, 27.3 µm; C, D, 6.5 µm.

numerous previous reports (Fedorov 1969; Moore 1972; Goldblatt 1983, 1985, 1988; Goldblatt & Johnson 1994) and this ploidy level is far more frequent than diploid (Goldblatt 1983), tetraploid (Fedorov 1969; Spies & Du Plessis 1986a) or octaploid (Fedorov 1969; Spies & Du Plessis 1986a). All the hexaploid plants in this study showed bivalent formation during meiosis (Figure 5A, B) suggesting an alloploid origin for this species.

The *B. pectinatus* (Figure 5D, E) specimen studied was tetraploid (n = 2x = 14), thus confirming previous reports which indicated the presence of both diploid and tetraploid specimens (Fedorov 1969; Moore 1970, 1971, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1996). *Bromus rigidus* is octaploid, confirming previous reports (Moore 1974; Goldblatt 1981). The presence of bivalents only (Figure 5F, G) indicates an alloploid origin for this species. Tetraploid, hexaploid, octaploid and decaploid specimens are also known (Fedorov 1969; Moore 1971, 1972, 1977; Goldblatt & Johnson 1994).

Tribe Triticeae

All *Hordeum* specimens had a basic chromosome number of 7 (Figure 6). Diploid and tetraploid specimens have been observed. Both ploidy levels showed normal meiosis and the formation of only bivalents in the tetraploid

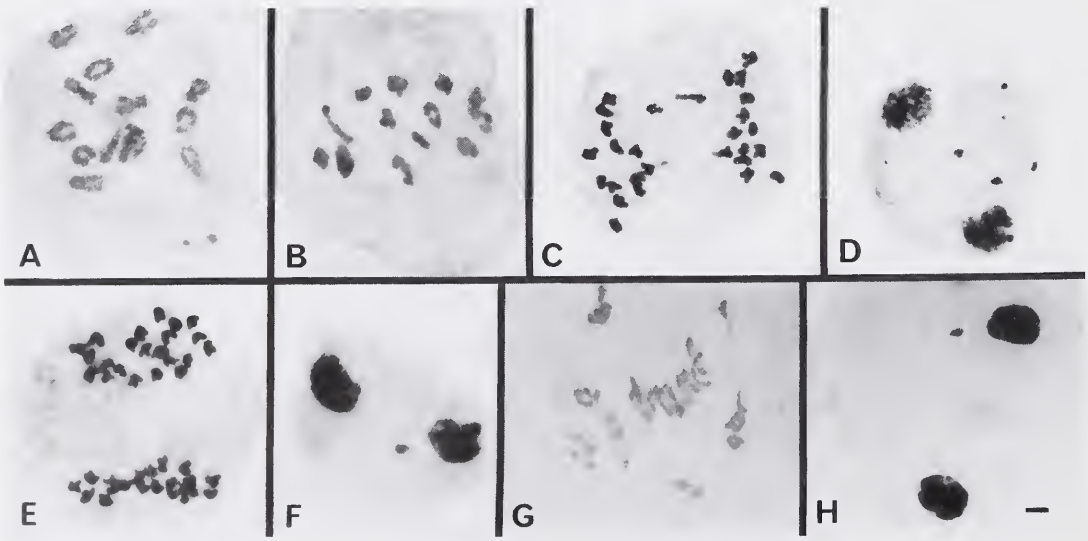

FIGURE 8.—Meiotic chromosomes in specimens of genus *Triticum* and × *Triticosecale*. A–D, *Triticum durum*, *Spies 5605*, n = 14: A, diakinesis with 14_{II}; B, early metaphase I with 14_{II}; C, anaphase I with a 14-14 segregation (one bivalent segregating late); D, telophase I with two micronuclei. E, F, *T. aestivum*, *Spies 5606*, n = 21: E, anaphase I with 21 chromosomes in each pole; F, one dyad with a micronucleus. G, H, × *Triticosecale*, *Spies 5610*, n = 21: G, metaphase I with bivalents; H, telophase I with a micronucleus. Scale bar: 6.5 µm.

specimens indicate an alloploid origin. The results of this study conform with previous results for these species (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998).

Both *Secale* species studied proved to be diploid (Figure 7) with normal meiosis in most cells. In one metaphase cell of *S. cereale* four univalents were observed. The results of this study confirm previous reports on this genus (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998).

This study confirmed a tetraploid status for *T. durum* (Figure 8A–D) and that both *T. aestivum* (Figure 8E, F) and × *Triticosecale* are hexaploids (Figure 8G, H) (Ornduff 1967, 1968, 1969; Fedorov 1969; Moore 1970, 1971, 1972, 1974, 1977; Goldblatt 1981, 1983, 1985, 1988; Goldblatt & Johnson 1990, 1991, 1994, 1996, 1998).

CONCLUSIONS

This study once again confirms the basic chromosome number of x = 7 for the tribes Poeae, Hainardieae, Aveneae, Bromeae and Triticeae, as well as the basic chromosome number of x = 9 for the tribe Meliceae. Further studies should be done to determine the degree of chromosome homology between the Meliceae and other representatives of the subfamily Pooideae, in order to establish the position of the Meliceae in this tribe. The basic number of x = 7 for the Hainardieae should also be investigated further to determine whether the South African plants differ from their Mediterranean counterparts in this respect.

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REFERENCES

CLAYTON, W.D. & RENVOIZE, S.A. 1986. Genera graminum—grasses of the world. *Kew Bulletin,* Additional Series 13: 1–389.

EDWARDS, D. & LEISTNER, O.A. 1971. A degree reference system for citing biological records in southern Africa. *Mitteilungen der Botanischen Staatssammlung, München* 10: 501–509.

FEDOROV, A.A. (ed.). 1969. *Chromosome numbers in flowering plants.* Academy of Sciences, USSR, Leningrad.

GIBBS RUSSELL, G.E., WATSON, M., KOEKEMOER, M., SMOOK, L., BARKER, N.P., ANDERSON, H.M. & DALLWITZ, M.J. 1990. Grasses of southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 58.

GOLDBLATT, P. 1981. Index to plant chromosome numbers 1975–1978. *Monographs in Systematic Botany* 5.

GOLDBLATT, P. 1983. Index to plant chromosome numbers 1979–1981 *Monographs in Systematic Botany* 8.

GOLDBLATT, P. 1985. Index to plant chromosome numbers 1982, 1983. *Monographs in Systematic Botany* 13.

GOLDBLATT, P. 1988. Index to plant chromosome numbers 1984, 1985. *Monographs in Systematic Botany* 23.

GOLDBLATT, P. & JOHNSON, D.E. 1990. Index to plant chromosome numbers 1986, 1987. *Monographs in Systematic Botany* 30.

GOLDBLATT, P. & JOHNSON, D.E. 1991. Index to plant chromosome numbers 1988, 1989. *Monographs in Systematic Botany* 40.

GOLDBLATT, P. & JOHNSON, D.E. 1994. Index to plant chromosome numbers 1990, 1991. *Monographs in Systematic Botany* 51.

GOLDBLATT, P. & JOHNSON, D.E. 1996. Index to plant chromosome numbers 1992, 1993. *Monographs in Systematic Botany* 58.

GOLDBLATT, P. & JOHNSON, D.E. 1998. Index to plant chromosome numbers 1994, 1995. *Monographs in Systematic Botany* 69.

MOORE, R.J. 1970. Index to plant chromosome numbers for 1968. *Regnum Vegetabile* 68.

MOORE, R.J. 1971. Index to plant chromosome numbers for 1969. *Regnum Vegetabile* 77.

MOORE, R.J. 1972. Index to plant chromosome numbers for 1970. *Regnum Vegetabile* 84.

MOORE, R.J. 1974. Index to plant chromosome numbers for 1972. *Regnum Vegetabile* 91.

MOORE, R.J. 1977. Index to plant chromosome numbers for 1973/74. *Regnum Vegetabile* 96.

ORNDUFF, R. 1967. Index to plant chromosome numbers for 1965. *Regnum Vegetabile* 50.

ORNDUFF, R. 1968. Index to plant chromosome numbers for 1966. *Regnum Vegetabile* 55.

ORNDUFF, R. 1969. Index to plant chromosome numbers for 1967. *Regnum Vegetabile* 59.

SPIES, J.J. & DU PLESSIS, H. 1986a. Chromosome studies on African plants. 1. *Bothalia* 16: 87, 88.

SPIES, J.J. & DU PLESSIS, H. 1986b. Chromosome studies on African plants. 2. *Bothalia* 16: 269, 270.

SPIES, J.J. & DU PLESSIS, H. 1987a. Chromosome studies on African plants. 3. *Bothalia* 17: 131–135.

SPIES, J.J. & DU PLESSIS, H. 1987b. Chromosome studies on African plants. 5. *Bothalia* 17: 257–259.

SPIES, J.J., NIEMAND, I.C., VAN WYK, S.M.C. & LIEBENBERG, E.J.L. 1997. Cytogenetic studies of the subfamily Pooideae (Poaceae) in South Africa. 3. The tribe Poeae. *Bothalia* 27: 75–82.

SPIES, J.J., SPIES, S.K., VAN WYK, S.M.C., MALAN, A.F. & LIEBENBERG, E.J.L. 1996a. Cytogenetic studies of the subfamily Pooideae (Poaceae) in South Africa. 1. The tribe Aveneae, subtribe Aveninae. *Bothalia* 26: 53–61.

SPIES, J.J., SPIES, S.K., VAN WYK, S.M.C., MALAN, A.F. & LIEBENBERG, E.J.L. 1996b. Cytogenetic studies of the subfamily Pooideae (Poaceae) in South Africa. 2. The tribe Aveneae, subtribes Alopecurinae and Phalaridinae. *Bothalia* 26: 63–67.

SPIES, J.J. & VOGES, S.P. 1988. Chromosome studies on African plants. 7. *Bothalia* 18: 114–119.

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Book Review

FIELD FLORA OF THE BRITISH ISLES by CLIVE STACE. 1999. *Cambridge University Press*, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, UK. Plastic cover: ISBN 0 521 65315 0, price £17.95, US$ 39.95.

A good friend of mine maintains a milk crate full of books as part of his standard camping gear, and so is as near as can be to always ready to give the best field identification possible of the scraps that surface at the end of the day on Tree Society outings. British (and, indeed, most European) lovers of plants in the field may be envied that their equivalent of the crate full of books will fit into a large pocket, though they may envy the size of the southern African flora that makes the crate necessary. This thought serves to make the comparisons chosen in this review almost self-explanatory: Clapham, Tutin and Warburg's (1968) venerable excursion flora (CTW), the Van Wyk (1997) tree book and Coates Palgrave's (1977) tree book. .

The first obvious difference is that the South African books are both larger and heavier than their British counterparts. The Van Wyks' book weighs in at 998g; Coates Palgrave is even heavier; but the new Stace is only 472g, and CTW the lightest of them all, at 420g. At home or in the office this may not be a significant factor, but after a long hike carrying everything one needs, every gram counts, and must be justified. One may be tempted to ask what the new field guide has to offer at three times the price of the old, not to mention the extra weight.

Stace does not give the detailed descriptions that CTW give. This difference is occasionally irritating, especially when one wishes for a little more detail than can be found in the synoptic key (as, for a very unfair example, with a scrap of *Euphrasia* from a hill overlooking Loch Lomond). However, this scrap highlights one significant difference between the old guide and the new, viz. CTW recognises only *E. officinalis* L. *sens. lat.* and *E. salisburgensis* Funck, whereas Stace keys out no less than 21 species in this very difficult genus. Indeed, Stace has included not only the strictly indigenous plants of the British Isles, but also naturalised plants and taxa only surviving as repeatedly replenished garden throw-outs. This means, of course, that Stace's book is useful to those who have to identify cultivated plants, and who are awaiting the publication of the final volume of *European garden flora*. Furthermore, Stace uses common names, which CTW do not, and he also includes maps and a millimetre rule in the endpapers; these are also missing from CTW. Stace's map and the list of British Isles vice counties is the only one this reviewer can recall seeing, and certainly serves to make labels on specimens of the few invaders common to both Britain and South Africa more comprehensible (British specimen labels cite vice counties—sometimes by number only—with the same determination as South African collectors use for quarter-degree grid references). Naturally, Stace's nomenclature reflects the most recent research; in contrast, not only is CTW thirty years older, but the preface in that handbook warns users that the authors did not adopt all the name changes arising from research undertaken for the preparation of *Flora europaea* that had been published at that time.

The new book reviewed here has a similar plastic cover to Mabberley's (1987) esteemed *The plant-book*; experience with the older book suggests that users of Stace's field guide will find it well-nigh indestructible, as a book destined to live in a pocket or backpack in inclement weather should be. And yet ... I took my copy of CTW to the Orkney Islands once, and it is none the worse for travelling loose in the car and being used as an emergency press for scrappy specimens. But that was only once: Stace's book is produced in a style sturdy enough to survive this maltreatment many times. An example of the printers' attention to detail is the rounded corners of the pages, which do not become dog-eared nearly as easily as square corners.

The attention to detail is just as evident in the appearance of the text. The most important pages, such as those bearing the list of abbreviations, and the start and end pages of pteridophytes, Pinopsida and Magnoliopsida have black margins, and keys to groups for which there are illustrations have grey margins with the relevant figure number at each lead where a taxon keys out.

This leads to one of the major differences between the British and South African productions: the former have few, if any, illustrations. Stace at least has some: the vital parts of plants belonging to difficult groups are illustrated, sometimes with line drawings and sometimes with photographs. Sadly, the author is let down by the quality of the photo mosaics illustrating *Carex* utricles in figures 560–563, where one could wish (for a start) that all the prints in one mosaic had been of uniform size. However, CTW give no illustrations at all. However, illustrations supply a further reason why the two South African books are so much larger and heavier than their British counterparts: the Van Wyks illustrate over 800 trees in colour and Coates Palgrave gives at least a drawing of a leaf for each species he discusses (over 1 000), and both give distribution maps. If Stace had done the same, his book would have been enormous, and the price astronomical.

The difference between the South African approach, providing a profusely illustrated guide to part of the flora, and the British (and European) manner, where the field guide is not or hardly illustrated, yet covers all taxa except the most obscure and ephemeral, is interesting. In part, it reflects the much more diverse flora of southern Africa: a 'Stace' for our area would be at least four times the size of the book reviewed here. One is tempted to say that because of the diversity and complexity of our flora, southern African enthusiasts need pictures of all the possibilities if they are to understand their specimens. However, I doubt that we have any groups more difficult than British *Euphrasia*. One wonders if the need for illustrations is not partly aesthetic, and partly a matter of expectations and, dare one say it, less expertise on the part of the general public than is expected in Britain and northwestern Europe. If so, one may well ask how they manage to encourage sufficient interest to make enough potential buyers persevere long enough in learning the terminology and classification to make a bare-bones field guide arranged in taxonomic order (not, as seems to be the current South African fashion, by flower colour or a few equally easily observed but less fallible characters) saleable.

Who, among likely readers of this review, would really need this book? British residents and other plant enthusiasts planning a visit to Britain or Ireland will be well served by it, obviously. For the latter group, one may parenthetically observe that the price of this book is not outrageous when seen in context: it translates to four return trips from Kew to central London, or three pub lunches. Those who need to identify plants cultivated or weedy not only in Britain but virtually throughout the Commonwealth and United States of America, will require this book.

If I ever have the good fortune to revisit Britain, I shall certainly want to take the Institute copy of Stace with me. And possibly one or two picture books from my own collection, such as Rose (1981) and the paperback Keble Martin (1972) ... shades of my friend's milk crate, though all three of these books are light, and smaller than A5.

REFERENCES

CLAPHAM, A.R., TUTIN, T.G. & WARBURG, E.F. 1968. *Excursion flora of the British Isles*, edn 2. Cambridge University Press, Cambridge.

COATES PALGRAVE, K. 1977. *Trees of southern Africa*. Struik, Cape Town.

KEBLE MARTIN, W. 1972. *The concise British flora in colour*. Sphere, London.

MABBERLEY, D.J. 1987. *The plant-book*, edn 1. Cambridge University Press, Cambridge.

ROSE, F. 1981. *The wild flower key*. Warne, London.

VAN WYK, B. & VAN WYK, P. 1997. *Field guide to trees of southern Africa*. Struik, Cape Town.

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Le Roux, P.H. N.Dip.(Hort.). Deputy Director. Head: Agricultural Support Services

Goldschmidt, S.M. Assistant Director. Personnel Practitioner. Management
Notten, Ms A.L. Senior Technician. Supervisor: Seed room
Powrie, Ms F.J. B.Sc.(Hons), N.Dip.(Hort.). Control Technician. Manager: Nursery

Arends, Ms S.J. Administration Clerk. Plant records
Coerecius, Mrs R. Senior Administration Clerk III
Crous, H.T. Chief Technician. Tissue culture
Duncan, G.D. N.Dip.(Hort.). Chief Technician. Bulbs
Engelbrecht, Mrs L.D. Technician. Plant records
Fredericks, Miss N.C.E. Information Officer II
Geduldt, D.C. Accounts Clerk II. Plant records
Gibson, Ms C. Communications Officer
Grace, T. Senior Storeman III
Hitchcock, A.N. N.H.Dip.(Hort.). Chief Technician. Plant production
Jacobs, A.P. Information Officer
Jamieson, Mrs H.G. N.Dip.(Parks & Rec.). Chief Technician. Restio/Asparagus
Jaques, R.F. Senior Techncian. New plant introductions
Jodamus, Ms N.L. Technician
Lawrence, E. Technician. Dell & Ericas
Lewis, N.I. Engraver II
Malan, Mrs C.E. B.Sc.(Hons). Principal Communications Officer
Manuel, I.P. Senior General Foreman. Seed room
Mathys, Mrs S.S.B. Senior Accounts Clerk II. Gates
Picane, Ms S. Auxiliary Services Officer II. Tissue Culture
Prins, F.B. Security II
Rudolph, A. Security II
Sani, Ms N. Typist I
Smith, Mrs A. Typist II
Solomons, T.C. Security Officer III
Townsend, D.J. N.Dip.(Hort.). Senior Technician. Trees & shrubs
Trautman, C.E. Artisan. Supervisor: Workshop
Van der Walt, Mrs L.E. N.Dip.(Hort.). Chief Technician. Herbaceous collections
Van Jaarsveld, E.J. M.Sc., N.Dip.(Hort.). Control Technician. Succulents
Williams, G.C. Gateman. Security II

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Ndzondo, Mrs P.G. Administration Aid II. Cleaner
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RESEARCH DIRECTORATE

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Wolfson, Mrs M.M. Ph.D. Deputy Director: Education and Research Support

Meyer, Mrs N.L. B.Sc.(Hons) Technician (contract worker)
Marais, Mrs A.C. Senior Secretary III
Steyn, Mrs E.M.A. D.Sc. Principal Scientist. Embryology

PLANT SYSTEMATICS SUBDIRECTORATE

PRETORIA

Smith, Prof. G.F. Ph.D., F.L.S. Systematics of succulents and rosulate, petaloid monocots

Arnold, T.H. Head: Data Management (Pretoria)
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Leistner, O.A. D.Sc. F.L.S. Scientist (contract worker)
Rourke, J.P. Curator: Compton Herbarium (Cape Town)
Williams, Ms R. Curator: Natal Herbarium (Durban)
Willis, C.K. Project Co-ordinator: SABONET (Pretoria)

COMPTON HERBARIUM—CAPE TOWN

Rourke, J.P. Ph.D., F.M.L.S., F.R.S.S.Af. Assistant Director. Systematics of southern African Proteaceae, Stilbaceae

Beyers, Mrs J.B.P. M.Sc. Principal Scientist. Assistant Curator: Collections. Taxonomy of the Gnidieae (Thymelaeaceae)
Chesselet, Ms P.C.M. M.Sc. Chief Scientific Officer
Conrad, Ms C. (SABONET contract worker)
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Foster, Mrs S.E. Senior Secretary III
Kurzweil, H. Ph.D. Specialist Scientist. Systematics of southern African terrestrial orchids
Leith, Mrs J. Senior Administration Clerk II
Manning, J.C. Ph.D. Specialist Scientist. Systematics of Iridaceae and Orchidaceae; anatomy
Marinus, Ms E.D.A. Principal Auxiliary Services Officer. Herbarium Assistant
Oliver, E.G.H. M.Sc. Principal Scientist. Taxonomy of the Ericoideae (Ericaceae)
Oliver, Mrs I.M. (contract worker)
Paterson-Jones, Mrs D.A. (née Snijman) Ph.D. Principal Scientist. Systematics of Amaryllidaceae; cladistics
Roux, J.P. N.T.C.III(Hort.), F.L.S., Ph.D. Principal Scientist. Systematics of Pteridophyta
Steiner, K.E. Ph.D. Specialist Scientist. Systematics of Scrophulariaceae and evolutionary interactions between oil-secreting flowers and oil-collecting bees (contract worker)

NATAL HERBARIUM—DURBAN

Williams, Ms R. B.Sc.(Hons), H.D.E. Chief Scientific Officer

Arumugam, Ms N. (SABONET contract worker)
Crouch, N.R. Ph.D. Principal Scientist. Ethnobotanist
Hlongwane, Mrs C. Administration Aid II. Cleaner
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Ngcobo, P.S. Auxiliary Services Officer II
Noble, Mrs H-E. Senior Administration Clerk III
Singh, Ms Y. M.Sc., H.E.D. Chief Scientific Officer. Taxonomy of *Zantedeschia*, plant identifications
Tomalin, Ms M. B.Sc.(Hons), B.Iurius. Data typist (contract worker)

NATIONAL HERBARIUM—PRETORIA

Koekemoer, Ms M. M.Sc. Assistant Director. Herbarium management. Taxonomy of Poaceae, Asteraceae: Gnaphalieae

Bredenkamp, Mrs C.L. M.Sc. Principal Scientist. Assistant Curator: Public relations. Taxonomy of *Vitex*, *Phylica,* Rhamnaceae, Sterculiaceae and other related families.
Herman, P.P.J. M.Sc. Principal Scientist. Assistant Curator: Personnel. Taxonomy of Asteraceae, Flora of Transvaal
Heymann, Mrs M.Z. T.E.Dip., B.A.(Education & History), B.Ed. Principal Auxiliary Services Officer. Assistant Curator: Services, loans, gifts and exchanges

Anderson, H.M. Ph.D. Principal Scientist. Palaeobotany, palaeogeography
Anderson, J.M. Ph.D. Specialist Scientist. Palaeobotany, palaeogeography
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Glen, H.F. Ph.D. Principal Scientist. Taxonomy of trees, herbarium for cultivated plants, and botanical collectors
Glen, Mrs R.P. M.Sc. Chief Scientific Officer. Taxonomy of ferns, water plants
Jordaan, Mrs M. M.Sc. Chief Scientific Officer. Taxonomy of Casuarinaceae–Connaraceae, *Maytenus*
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Makgakga, K.S. Auxiliary Services Officer II. Mounter of vascular plants
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Van Wyk, E. M.Sc. Scientific Officer. Seedbank manager, Kew Millenium Seedbank Project (contract worker)
Victor, Ms J.E. M.Sc., H.Dip.Journ. Senior Scientific Officer. Taxonomy of Rutaceae, Asclepiadaceae
Welman, Ms W.G. M.Sc. Senior Scientist. Taxonomy of Convolvulaceae, Solanaceae, Cucurbitaceae, Campanulaceae, Asteraceae, Acanthaceae

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Hawker, Mrs L.C. Scientist (contract worker)
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Prentice, Ms C. Scientist (contract worker)
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Liebenberg, Mrs E.J.L. Head: Administration
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EDUCATION

GOLD FIELDS CENTRE—CAPE TOWN

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Honig, Ms M. Senior Communications Officer. Interpretation
Huët, Mrs H. Senior Administration Officer II
Mgodeli, W. Bus driver
Mkefe, T.X. SPTD. Principal Communications Officer
Tyhokolo, Ms S.E. SPTD. Senior Communications Officer

BLOEMFONTEIN

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PIETERMARITZBURG

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PRETORIA

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Nkosi, P.B. Administration Clerk II. Bookstore
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Turck, Mrs S. B.A.(Information Design). Industrial Technician. Graphic design

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ADMINISTRATION—PRETORIA

Liebenberg, Mrs E.J.L. M.Sc. Chief Scientific Officer. Cytotaxonomy. Manager

Götzel, Mrs A. Senior Telecom. Operator III
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Koehne, Mrs R.W.R. Senior Registration Clerk
Makgobola, Mrs M.R. Administration Aid II
Malefo, Mrs R.P. Administration Aid II
Maphuta, Mrs M.S. Administration Aid II
Martin, Ms M.A. Senior Administration Clerk II
Nkosi, Mrs M.P. Administration Aid I
Phaahla, M.C. Administration Aid II
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ECOLOGY AND CONSERVATION SUBDIRECTORATE

CAPE TOWN

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Powrie, L.W. M.Sc. Chief Scientific Officer. Spatial modelling, databases

CLIMATE CHANGE

Rutherford, M.C. Ph.D., Dip.(Datamet.). Modelling, global change

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Musil, C.F. Ph.D. Specialist Scientist. Ecophysiology, modelling
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Wand, Ms S.J.E. M.Sc.(Agric.) Senior Scientist. Ecophysiology, modelling

CONSERVATION BIOLOGY

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Bösenberg, J.de Wet. B.Sc.(Hons) Chief Scientific Officer. Cycad biology, conservation farming
Charlton, Ms V.J. Secretary. Protea Atlas Project (contract worker)
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Rebelo, AG. Ph.D.(Zoology) Principal Scientist. Protea Atlas Project

DESERTIFICATION

Hoffman, M.T. Ph.D. Specialist Scientist. Disturbance and historical ecology

Cloete, M.J. Fieldwork (contract worker)
Eccles, J. M.Sc. GIS (contract worker)
Petersen, Ms A. B.Sc.(Hons). Senior Scientific Officer. Land use and vegetation mapping
Solomon, Ms A.M. B.Sc.(Hons). M.Sc. student. Impact of fuel wood collection (contract worker)
Todd, S.W. M.Sc. Scientist. Communal rangelands (contract worker)

HORTICULTURAL RESEARCH

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PUBLICATIONS BY THE STAFF

1 April 1998–31 March 1999

ALLSOPP, J.C.N., BOND, W.J., MIDGLEY, G.F. & RUTHERFORD, M.C. 1998. Global climate change and the South African flora: past, present and future. *Pages* 6,1: 19.

ANDERSON, H.M. 1998. Heidi Anderson (Palaeobotanist) National Botanical Institute, Pretoria is interviewed by Sherlock Holmes. *Plantlife* 19: 41.

ANDERSON, H.M. & ANDERSON, J.M. 1997 (March 1998). Towards new paradigms in Permo-Triassic Karoo palaeobotany (and associatcd faunas) through the past 50 years. *Palaeontologia Africana*, commemorative volume, 33: 11, 12.

ANDERSON, H.M. & ANDERSON, J.M. 1998a. The heyday of the gymnosperms: was it to be found in the Late Triassic? In 'Gondwana10: event stratigraphy of Gondwana', Symposium held at University of Cape Town, July 1998. *Journal of African Earth Sciences* 27, Special abstracts issue: 5, 6.

ANDERSON, J.M. & ANDERSON, H.M. 1998b. In search of the

world's richest flora: looking through the Late Triassic Molteno window. In 'Gondwana10: event stratigraphy of Gondwana', Symposium held at University of Cape Town, July 1998. *Journal of African Earth Sciences* 27, Special abstracts issue: 6, 7.

ANDERSON, J.M., ANDERSON, H.M. & CRUICKSHANK, A.R.I. 1998. The late Triassic ecosystems of the Molteno/Lower Elliot biome of southern Africa. *Palaeontology* 41: 387–421.

ANDERSON, J.M., KOHRING, R. & SCHLUTER, T. 1998. Was insect biodiversity in the Triassic akin to today?—a case study from the Molteno Formation (South Africa). *Entomologia Generalis* 23: 15–26.

ARCHER, C. 1998a. A new combination in *Isolepis* (Cyperaceae). *Bothalia* 28: 41, 42.

ARCHER, C. 1998b. *Coleochloa setifera* new to the flora of KwaZulu-Natal (Cyperaceae). *Bothalia* 28: 190–192.

ARCHER, C. 1998c. *Siphonochilus kirkii, Hedychium*. In R.M. Smith, *FSA* contributions 11: Zingiberaceae. *Bothalia* 28: 37, 38.

ARCHER, R.H. 1998a. A new species of *Euphorbia* from the Kaokoveld. *South African Journal of Botany* 64: 258–260.

ARCHER, R.H. 1998b. Southern African Celastraceae. *PlantLife* 19: 5–8.

ARCHER, R.H. 1998c. *Euphorbia leistneri* (Euphorbiaceae), a new species from the Kaokoveld (Namibia). *South African Journal of Botany* 64: 258–260.

ARCHER, R.H. 1998d. White pear. *Tree of the Year 1998*. Department of Water Affairs & Forestry.

ARCHER, R.H. & VAN WYK, A.E. 1998a. A taxonomic revision of *Maurocenia* (Celastraceae), a Western Cape monotypic endemic. *Bothalia* 28: 7–10.

ARCHER, R.H. & VAN WYK, A.E. 1998b. A taxonomic revision of *Elaeodendron* Jacq. (Cassinoideae: Celastraceae). *South African Journal of Botany* 64: 93–109.

ARCHER, R.H. & VAN WYK, A.E. 1998c. A taxonomic revision of *Allocassine* N. Robson. *South African Journal of Botany* 64: 189–191.

ARNOLD, T.H. 1998. PRECIS specimen database user guide published. *SABONET News* 3: 31.

ARNOLD, T.H. & MÖSSMER, M. (compilers). 1998. *Plant taxonomic and related projects in southern Africa*. Southern African Botanical Network Report No. 5. SABONET & National Botanical Institute, Pretoria.

ARNOLD, T. & WILLIS, C. 1998. Computerisation of southern African herbaria. *SABONET News* 3: 82–85.

ASHWELL, A. 1998a. Microscope magic. *Veld & Flora* 84: 75.

ASHWELL, A. 1998b. Environmental education in botanic gardens. *Veld & Flora* 84: 110, 111.

ASHWELL, A. 1998c. Editorial: Plants, people and Africa: establishing new educational programmes. *Roots* 16 (June): 2, 3.

ASHWELL, A. 1998d. Environmental education in botanic gardens. *SABONET News* 3: 144–147.

ASHWELL, A. 1998e. Education programme management and transformation: the influence of education for sustainability. *Southern African Journal of Environmental Education* 18: 74–78.

ASHWELL, A. & BOBO-MRUBATA, P. 1998. Environmental action for change. *Roots* 16 (June): 24–26.

BALKWILL, K., JEPPE, C. & GLEN, H.F. 1998. Barbara Jeppe, a member *extraordinaire*. *Trees in South Africa* 47: 57, 58.

BAYER, M.B., EGGLI, U., VAN JAARSVELD, E., SMITH, G.F. & SUPTHUT, D.J. 1999. *From Adrian Haworth to* Haworthia. Haworthia *and related South African succulents*. Haworthia Society, St Michaels on Wyre.

BEYERS, J.B.P. & VAN WYK, A.E. 1998. A new species of *Lachnaea* endemic to the southeastern mountains of the Western Cape (Thymelaeaceae). *Bothalia* 28: 49–53.

BIRCHER, C., PRENTICE, C., CROUCH, N. & SYMMONDS, R. 1998. Conservation concerns for *Bowiea volubilis*, an unusually succulent member of the Hyacinthaceae. *Herbertia* 53: 81–89.

BÖSENBERG, J. DE W. 1998. The rapid decline of a cycad population. *Encephalartos* 54: 25–28.

BREDENKAMP, C.L. & VAN WYK, A.E. 1999. Mucilaginous cell walls of leaf epidermis in *Passerina* (Thymelaeaceae). *Botanical Journal of the Linnean Society* 129: 223–238.

BROWN, N.A.C., JAMIESON, H. & BOTHA, P.A. 1998. Propagation and cultivation of South African restios. *Proceedings of the Inaugural Conference of the South African Region of the International Plant Propagators' Society, Pretoria, 4–7 November 1997*: 714–719.

BROWN, N.A.C., KOTZE, G. & BOTHA, P.A. 1998a. *Grow Proteas*. Kirstenbosch Gardening Series. National Botanical Institute, Cape Town.

BROWN, N.A.C., KOTZE, G. & BOTHA, P.A. 1998b. *Grow Restios*. Kirstenbosch Gardening Series. National Botanical Institute, Cape Town.

BROWN, N.A.C. & VAN STADEN, J. 1998. Nature's solution to dormancy—smoke stimulated seed germination. *Prophyta* (November): 26, 27. (special edition for the Horticultural Trade Fair in Amsterdam in October 1998).

BURGOYNE, P.M. 1998a. Notes on African plants: Crassulaceae. A new record for *Crassula maputensis* R.Fernandes. *SABONET News* 3: 25.

BURGOYNE, P.M. 1998b. Finding a place in the sun: where does *Ruschia purpureostyla* belong? *Aloe* 35: 60, 61.

BURGOYNE, P.M. 1998c. *Jensenobotrya lossowiana*: an island of genetic material in a sea of sand. *Aloe* 35: 94–96.

BURGOYNE, P.M., BURROWS, J., BURNS, S., HANKEY, A., JORDAAN, M., LÖTTER, M.C., MCMURTRY, D. & TURNER, S. 1998. The *PlantLife* Excursion to the Miombo Woodlands of Zimbabwe. *PlantLife* 20: 9–15.

BURGOYNE, P. & GERMISHUIZEN, G. 1998. Succulent euphorbias from Namibia. *Veld & Flora* 84: 93, 94.

BURGOYNE, P.M. & SMITH, G.F. 1998. Preparing useful herbarium specimens of succulent and other plants with fleshy parts. *Aloe* 35: 102, 103.

BURGOYNE, P., SMITH, G.F. & CHESSELET, P. 1998. *Hammeria*, a new genus of Aizoaceae from South Africa. *Cactus & Succulent Journal (U.S.)* 70: 203–208.

CAFFERTY, S. & BEYERS, J. 1999. (1398) Proposal to reject the name *Lachnaea conglomerata* (Rhamnaceae). *Taxon* 48: 171, 172.

CHESSELET, P., HARTMANN, H.E.K., HAHN, N., BURGOYNE, P. & SMITH, G.F. 1998. Taxonomic notes on the genus *Khadia* (Mesembryanthemaceae/Aizoaceae). *Bothalia* 28: 25–33.

CODD, L.E. & GLEN, H.F. 1998. Some Tree Society notables. *Trees in South Africa* 47: 46–49.

COWLING, R.M. & MCDONALD, D.J. 1998. Local endemism and plant conservation in the Cape Floristic Region. In P.W. Rundel, G. Montenegro & F.M. Jaksic, *Landscape disturbance and biodiversity in Mediterranean-type ecosystems*: 171–188. Springer-Verlag, Berlin.

CRAIB, C. & HANKEY, A. 1998. *Ledebouria galpinii* Venter, a rare mountain top mist-belt species. *Herbertia* 53: 54–58.

CROUCH, N.R., NICHOLS, G. & HUTCHINGS, A. 1998. *Umondi*. The versatile herb of Africa. *Custos* (May): 24, 25.

CROUCH, N.R. & SYMMONDS, R. 1999. *Umababaza* of the Zulu. The traditional value and propagation of *Ornithogalum longibracteatum* (Hyacinthaceae). *PlantLife* 20: 27–29.

CROUS, H. 1998a. Yuppie *Disa*. *Veld & Flora* 84: 134.

CROUS, H. 1998b. Review: Growing South African indigenous orchids, by K.H.K. Woodrich. *Veld & Flora* 84: 102.

DE LANGE, A.M., CROUCH, N.R., PRENTICE, C.A., SWARTZ, P. & HAWKER, L.C. 1998. Propagation and cultivation of the rare succulent, *Euphorbia woodii* N.E.Br., a Zulu medicinal plant from the eastern seaboard of South Africa. *Aloe* 35: 98–101.

DONALDSON, J.S. 1998a. Life in the slow lane: the biology of cycad populations. *Encephalartos* 56: 14, 15.

DONALDSON, J.S. 1998b. Development: searching for seeds from South African cycads and palms. *Newsletter of the Montgomery Botanical Center* 6: 5.

DONALDSON, J.S. & HUBBUCH, C. 1997 (January 1998). An emerging international network of botanic gardens for cycad conservation. In D.H. Touchell, K.W. Dixon, A.S. George & R.T.Wills, Conservation into the 21st Century. *Proceedings of the 4th International Botanic Gardens Conservation Congress, Perth, W. Australia, 1995*.

DONALDSON, J.S., HILTON-TAYLOR, C., MCDONALD, D.J. & REBELO, A.G. 1997 (January 1998). Research in plant conservation biology: an aid for defining the role of botanic gardens in the conservation of plant diversity in South Africa. In D.H. Touchell, K.W. Dixon, A.S. George & R.T.Wills, Conservation into the 21st Century. *Proceedings of the 4th International Botanic Gardens Conservation Congress, Perth, W. Australia, 1995*.

DONALDSON, J.S. & WINTER, J.H.S. 1998. *Grow cycads*. Kirstenbosch Gardening Series. National Botanical Institute, Cape Town.

DUNCAN, G.D. 1998a. The Kay Bergh Bulb House. *Veld & Flora* 84: 80, 81.

DUNCAN, G.D. 1998b. *Grow* Agapanthus. Kirstenbosch Gardening Series. National Botanical Institute, Cape Town.
DUNCAN, G.D. 1998c. Five new species of *Lachenalia* (Hyacinthaceae) from arid areas of Namibia and South Africa. *Bothalia* 28: 131–139.
DUNCAN, G.D. 1998d. Notes on the genus *Lachenalia*. *Herbertia* 53: 40–48.
DUNCAN, G.D. 1998e. Review: *Gladiolus* in southern Africa, by P. Goldblatt & J. Manning. *Veld & Flora* 84: 140, 141.
FISH, L. 1999. Preparing herbarium specimens. *Strelitzia* 7. National Botanical Institute, Pretoria.
GERMISHUIZEN, G. 1998a. A new species of *Pearsonia* from Mpumalanga, South Africa (Fabaceae). *Bothalia* 28: 57, 58.
GERMISHUIZEN, G. 1998b. A new species of *Rhynchosia* from South Africa (Fabaceae). *Bothalia* 28: 58–60.
GERMISHUIZEN, G., FISH, L. & BURGOYNE, P.M. 1998. Collecting in Namibia. *Veld & Flora* 84: 126, 127.
GLEN, H.F. 1998a. Colonial-period types deposited at Berlin, or, the Berlin bomb of 1943. *SABONET News* 3: 41–43.
GLEN, H.F. 1998b. Review: Wild flowers of northern South Africa, by A. Fabian & G. Germishuizen, 1997. *African Wildlife* 52: 45.
GLEN, H.F. 1998c. Obituary: John Denzil Carr (1916–1997). *Bothalia* 28: 117, 118.
GLEN, H.F. 1998d. Review: Plant collectors in Madagascar and the Comoro Islands, by L.J. Dorr, 1997. *Bothalia* 28: 126.
GLEN, H.F. 1998e. Tribute to David Spencer Hardy (1931–1998). *Aloe* 35: 32–34.
GLEN, H.F. 1998f. Obituary: David Spencer Hardy (1931–1998). *SABONET News* 3: 67–70.
GLEN, H.F. 1998g. Letter from Washington. *SABONET News* 3: 92, 93.
GLEN, H.F. 1998h. *FSA* contributions 12: Plantaginaceae. *Bothalia* 28: 151–157.
GLEN, H.F. 1998i. Obituary: David Spencer Hardy (1931–1998). *Bothalia* 28: 239–243.
GLEN, H.F. 1998j. Editorial: our jubilee volume. *Trees in South Africa* 46: 2.
GLEN, H.F. 1998k. The Society's periodicals. *Trees in South Africa* 46: 14, 15.
GLEN, H.F. 1998l. *Acacia caffra*. *Trees in South Africa* 46: 16, 17.
GLEN, H.F. 1998m. Some notes on Mr Harvey's biography of Bertie Mogg. *Trees in South Africa* 46: 40.
GLEN, H.F. 1998n. *Combretum moggii*. *Trees in South Africa* 46: 44, 45.
GLEN, H.F. 1998o. Obituary: John Denzil Carr (1916–1997). *Trees in South Africa* 46: 59, 60.
GLEN, H.F. 1998p. Notes on distribution maps in southern Africa. In J. Lundqvist, *Index Holmiensis IX*. Swedish Museum of Natural History, Stockholm.
GLEN, H.F. 1998q. The state of horticultural taxonomy in South Africa. *The Third International Symposium on the Taxonomy of cultivated plants, Edinburgh, 1998*: 39.
GLEN, H.F. 1998r. The botanist who made boxes. *South African Journal of Science* 94: 47, 48.
GLEN, H.F. & MOGG, A.O.D. 1998. An early product of the study group. *Trees in South Africa* 46: 18–20.
GLEN, H.F. & NAGENDRAN, C.R. 1998. The paper chase. *SABONET News* 3: 43–48.
GLEN, H.F., WILLIS, C.K. & GLEN, R.P. 1998. The paper chase. *SABONET News* 3: 81, 86–93.
GLEN, H.F., WILLIS, C.K., GLEN, R.P. & MÖSSMER, M. 1998. The paper chase. *SABONET News* 3: 172–183.
GLEN, R.P. 1998a. Review: Aquatic and wetland plants of India, by C.D.K. Cook, 1996. *SABONET News* 3: 81, 86, 87.
GLEN, R.P. 1998b. Review: The Shell Field Guide Series, Part 1. Trees and shrubs of the Okavango Delta: medicinal uses and nutritional value, by Veronica Roodt. 1998. *SABONET News* 3: 174–176.
GLEN, R.P. 1999. Pressing and mounting aquatic plants. In L. Fish, Preparing herbarium specimens. *Strelitzia* 7: 45–48.
GOLDBLATT, P., BERNHARDT, P. & MANNING, J.C. 1998. Pollination of petaloid geophytes by monkey beetles (Scarabaeidae: Rutelinae: Hopliini) in southern Africa. *Annals of the Missouri Botanical Garden* 85: 215–230.
GOLDBLATT, P. & MANNING, J.C. 1998a. Adaptive radiation of bee-pollinated *Gladiolus* species (Iridaceae) in southern Africa. *Annals of the Missouri Botanical Garden* 85: 492–517.
GOLDBLATT, P. & MANNING, J.C. 1998b. Gladiolus *in southern Africa*. Fernwood Press, Cape Town.
GOLDBLATT, P., MANNING, J.C. & BERNHARDT, P. 1998. Notes on the pollination of *Gladiolus brevifolius* (Iridaceae) by bees (Anthophoridae) and bee mimicking flies (*Psilodera*: Acroceridae). *Journal of the Kansas Entomological Society* 70: 297–304.
HANKEY, A. 1998a. A rescue account of a population of *Crinum graminicola* near Pretoria. *Herbertia* 53: 198–200.
HANKEY, A. 1998b. The JCI Geological Trail at the Witwatersrand National Botanical Garden. *Veld & Flora* 84: 110.
HANKEY, A. & TURNER, S. 1998. *Hesperantha candida* Bak. (Iridaceae). Still alive and strong on the Witwatersrand. *PlantLife* 19: 21.
HERMAN, P.P.J. 1998a. Review: Field guide to the wild flowers of the Highveld, by Braam van Wyk & Sasa Malan. *Veld & Flora* 84: 102.
HERMAN, P.P.J. 1998b. A note on the *Brachylaena discolor* complex (Asteraceae). *Bothalia* 28: 42–45.
HERMAN, P.P.J. 1998c. A note on the Vernay-Lang Kalahari expedition March to September, 1930. *SABONET News* 3: 77.
HERMAN, P.P.J. 1998d. Key to the species of the genus *Hertia* in southern Africa (Asteraceae). *Bothalia* 28: 192.
HERMAN, P.P.J. 1998e. New plant record for Botswana. *SABONET News* 3: 13, 14.
HERMAN, P.P.J. 1998f. The leaf anatomy of two *Clerodendrum* species (Verbenaceae). *South African Journal of Botany* 64: 246–249.
HERPPICH, W.B., HERPPICH, M., TÜFFERS, A.,VON WILLERT, D.J., MIDGLEY, G.F. & VESTE, M. 1998. Photosynthetic responses to CO_2 concentration and photon fluence rates in the CAM-cycling plant, *Delosperma tradescantioides* Bgr. (Mesembryanthemaceae). *New Phytologist* 138: 433–440.
HERPPICH, W.B., MIDGLEY, G.F., HERPPICH, M., TÜFFERS, A., VESTE, M. & VON WILLERT, D.J. 1998. Interactive effects of photon fluence rates and drought on CAM-cycling in *Delosperma tradescantioides* (Mesembryanthemaceae). *Physiologia Plantarum* 102: 148–154.
HILTON-TAYLOR, C. 1998a. Conservation. In G.F. Smith, P. Chesselet, E.J. van Jaarsveld, S.A. Hammer, H.E.K. Hartmann, B-E. van Wyk, P. Burgonye, C. Klak & H. Kurzweil, *Mesembs of the World.*: 12. Briza Publications, Pretoria.
HILTON-TAYLOR, C. 1998b. *Mimetes chrysanthus*: vulnerable beauty. *World Conservation* (the IUCN Bulletin) 2/98: 11, 12.
HILTON-TAYLOR, C. 1998c. Lies, damned lies, and statistics. *SABONET News* 3: 171.
HILTON-TAYLOR, C. 1998d. *1997 IUCN Red list of threatened plants*. IUCN Publications Services Unit, Cambridge, UK.
HILTON-TAYLOR, C. 1998e. Ten plants: portraits from the edge. *World conservation* 2/98: 11, 12.
HILTON-TAYLOR, C. 1998f. Contributed 73 status reports and conservation assessments of southern African trees. In S. Oldfield, C. Lusty & A. MacKinven, *The World list of threatened trees*. World Conservation Press, Cambridge.
HOFFMAN, M.T., LINDEQUE, L. & NTSONA, Z.N. 1999. Land degradation in commercial and communal areas of South Africa: preliminary results from a rapid participatory appraisal. *Proceedings of the Desert Margins Program Workshop 'Appropriate Restoration Technologies in South Africa', Potchefstroom, 23–26 March, 1998.*
HUNTLEY, B.J. 1998a. The Kirstenbosch Development Campaign: a dream realized. *Veld & Flora* 84: 44–47.
HUNTLEY, B.J. 1998b. Lessons learned from the Kirstenbosch Development Campaign. *Veld & Flora* 84: 78, 79.
HUNTLEY, B.J., MATOS, E.M., AYE, T.T., NERMARK, U., NAGENDRAN, C.R., SEYANI, J.H., DA SILVA, M.A.C., IZIDINE, S., MAGGS, G.L., MANNHEIMER, C., KUBIRSKE, R., SMITH, G.F., KOEKEMOER, M., DLAMINI, G.M., PHIRI, P.S.M., NOBANDA, N. & WILLIS, C.K. 1998. *Inventory, evaluation and monitoring of botanical diversity in southern Africa: a regional capacity and instituton building network (SABONET)*. Southern African Botanical Diversity Network Report No. 4. SABONET, Pretoria.
HURTER, J. 1998. An African rain forest at the Lowveld National Botanical Garden. *Veld & Flora:* 84: 77.
JOHNSON, S. & KURZWEIL, H. 1998. Systematics and phylogeny of the *Satyrium erectum* group (Orchidaceae), with descriptions of two new species from the Karoo region of South Africa. *Botanical Journal of the Linnean Society* 127: 179–194.
JOHNSON, S.D., STEINER, K.E., WHITEHEAD, V.B. & VOGELPOEL, L. 1998. Pollination ecology and maintenance of species

in co-occurring *Disa racemosa* L. f. and *Disa venosa* Sw. (Orchidaceae) in South Africa. *Annals of the Missouri Botanical Garden* 85: 231–241.

JORDAAN, M. 1999. Studies in subfamily Celastroideae (Celastraceae): generic concepts. *PlantLife* 20: 7, 8.

JORDAAN, M. & VAN WYK, A.E. 1998a. Systematic studies in subfamily Celastroideae (Celastraceae) in southern Africa: the genus *Putterlickia*. *South African Journal of Botany* 64: 322–329.

JORDAAN, M. & VAN WYK, A.E. 1998b. Systematic studies in subfamily Celastroideae (Celastraceae) in southern Africa: *Gloveria*, a new monotypic genus. *South African Journal of Botany* 64: 299–302.

KLEIN, H. & BREDENKAMP, C.L. 1998. Thorn-apple 'trips' can be terminal. *Farmers' Weekly*, September 4: 16–18.

KURZWEIL, H. 1998a. The orchids of Mt Kinabalu (Malaysia). *South African Orchid Journal* 29: 63–68.

KURZWEIL, H. 1998b. The value of early floral ontogeny in the systematics of Orchidaceae. In Monocots II, Abstract: 35. *Second International Congress on the Comparative Biology of the Monocotyledons and Third Symposium on Grass Systematics and Evolution*. Sydney, Australia.

LADD, P.G., NÄNNI, I. & THOMSON, G.J. 1998. Unique stigmatic structure in three genera of Proteaceae. *Australian Journal of Botany* 46: 479–488.

LEISTNER, O.A. 1998a. Review: Field guide to trees of southern Africa, by B. van Wyk & P. van Wyk, 1997. *Bothalia* 28: 126, 127.

LEISTNER, O.A. 1998b. How to write articles for publication 2. *SABONET News* 3: 5–7.

LEISTNER, O.A. 1998c. How to write articles for publication 3. *SABONET News* 3: 55–58.

LEISTNER, O.A. 1998d. How to write articles for publication 4. *SABONET News* 3: 120–123.

LINDER, H.P, JOHNSON, S.D. & LILTVED, W.R. 1998. *Disa virginalis* (Diseae: Orchidioideae: Orchidaceae): a new species from South Africa. *Novon* 8: 405–407.

MAGGS, GILLIAN & GERMISHUIZEN, G. 1998. Obituary: Michiel (Mike) Adriaan Niklaas Müller (1948–1997). *Bothalia* 28: 123, 124.

MALCOLM, N. 1998a. South Africa comes of age at the Chelsea Flower Show. *Veld & Flora* 84: 76.

MALCOLM, N. 1998b. Mystery fungus attacks Camphor trees at Kirstenbosch. *Veld & Flora* 84: 76.

MASILO, T.K. 1998. Celebrating traditional knowledge. *Roots* 16: 34.

MCCARTAN, S.A. & CROUCH, N.R. 1998. *In vitro* culture of *Mondia whitei* (Periplocaceae), a threatened Zulu medicinal plant. *South African Journal of Botany* 64: 313, 314.

MCDONALD, D.J. 1998a. Review: Vegetation of southern Africa, edited by R.M. Cowling, D.M. Richardson & S.M. Pierce. 1997. *Bothalia* 28: 125–126.

MCDONALD, D.J. 1998b. Review: Vegetation of southern Africa, edited by R.M. Cowling, D.M. Richardson & S.M. Pierce. 1997. *South African Journal of Science* 94: 407, 408.

MCDONALD, D.J. 1998c. The enigma of the Geissolomataceae. *Veld & Flora* 84: 122, 123.

MCDONALD, D.J. 1998d. Review: ENGEN Afrikatourism Guide. A guide for environment-orientated travel in the Western Cape Province of South Africa, by M. & A. Scott. 1988. *Veld & Flora* 84: 103.

MEEROW, A.W. & SNIJMAN, D.A. 1998. Amaryllidaceae. In K. Kubitzki, *The families and genera of vascular plants* 3: 83–110. Springer, Berlin.

MEYER, N.L. & SMITH, G.F. 1998. *Astroloba corrugata*: description of a long-known species in a southern African endemic alooid genus (Asphodelaceae: Alooideae). *Bothalia* 28: 60–62.

MIDGLEY, G.F., BOND, W.J., ROBERTS, R. & WAND, S.J.E. 1998. Will Gullivers travel? Potential causes of changes in savanna tree success due to rising atmospheric CO2. *Proceedings of the Kalahari Transect Regional Scientific Workshop, Gaborone, 10–13 June, 1998*.

MIDGLEY, G.F., WAND, S.J.E. & MUSIL, C.F. 1998. Repeated exposure to enhanced UV-B radiation in successive generations increases developmental instability (leaf fluctuating asymmetry) in a desert annual. *Plant, Cell and Environment* 21: 437–442.

MILTON, S.J., DEAN, W.R.J., KERLEY, G.I.H., HOFFMAN, M.T. & WHITFORD, W.G. 1999. Dispersal of seeds as nest material by the cactus wren. *Southwestern Naturalist* 43: 449–452.

MUSIL, C.F. 1998. Performance of the arid-environment annual *Dimorphotheca sinuata* DC. (Asteraceae) after four generations of differential ultraviolet-B exposure. In H. Honingsmann, R.M. Knobler, F. Trautinger & G. Jori, Landmarks in photobiology: 54–58. *Proceedings of the 12th International Congress on Photobiology, Vienna, Austria, 31 August to 6 September, 1996*. OEMF spa, Milano, Italy.

MUSIL, C.F., MIDGLEY, G.F. & WAND, S.J.E. 1999. Carry-over of enhanced UV-B exposure effects to successive generations of a desert annual: interaction with atmospheric CO2 and nutrient supply. *Global Change Biology* 5: 311–332.

MUSIL, C.F., NEWTON, R.J. & FARRANT, J.M. 1998. Ultraviolet irradiation effects on serotinous *Leucadendron laureolum* seeds: altered seed physiology and ultrastructure and seedling performance. *Plant Ecology* 139: 25–34.

NGWENYA, M.A. 1998. Translation into Zulu of *Ukwenza Luhlaza ugu LwaKwazulu-Natal*. Greening guide series. National Botanical Institute, Cape Town.

OLIVER, I.B. 1998. *Grow succulents*. Kirstenbosch Gardening Series, National Botanical Institute, Cape Town.

OLIVER, E.G.H. 1998. Regional news update: news from South Africa. *SABONET News* 3: 97.

OLIVER, E.G.H. & OLIVER, I.M. 1998. Three new species of *Erica* (Ericaceae) from South Africa. *Novon* 8: 267–274.

PEROLD, S.M. 1998a. Studies in the liverwort genus *Fossombronia* (Metzgeriales) from southern Africa. 5. A new species from Northern and Western Cape. *Bothalia* 28: 1–5.

PEROLD, S.M. 1998b. *Fossombronia rwandaensis*, a new species from tropical Africa (Metzgeriales–Fossombroniaceae). *Bothalia* 28: 45–49.

PEROLD, S.M. 1998c. *Asterella abyssinica* newly reported from South Africa and Malawi (Aytoniaceae, Hepatophyta). *Bothalia* 28: 53–56.

PEROLD, S.M. 1998d. Studies in the liverwort genus *Fossombronia* (Metzgeriales) from southern Africa. 6. New species from Lesotho, Swaziland and Mpumalanga and new records from Lesotho. *Bothalia* 28: 159–165.

PEROLD, S.M. 1998e. *Fossombronia occidento-africana*: is it conspecific with *F. indica*? (Metzgeriales–Fossombroniaceae). *Bothalia* 28: 183–187.

PRENTICE, C.A. & ARNOLD, T.H. 1998. *PRECIS specimen database user guide*. Southern African Botanical Network Report No. 3. SABONET & National Botanical Institute, Pretoria.

PRENTICE, C., SYMMONDS, R. & CROUCH, N.R. 1998. *Ikhathazo* in trouble. Reversing the declining fortunes of *Alepidea amatymbica* (Apiaceae). *PlantLife* 19: 22–24.

REBELO, A.G. (ed.) 1999. *Interim distribution map. KwaZulu-Natal edn* 1. Protea Atlas Project, Kirstenbosch.

REBELO, A.G. & REBELO, P. (eds). 1998a. *Protea Atlas Newsletter* 38. Protea Atlas Project, University of Cape Town.

REBELO, A.G. & REBELO, P. (eds). 1998b. *Protea Atlas Newsletter* 39. Protea Atlas Project, University of Cape Town.

REBELO, A.G. & REBELO, P. (eds). 1998c. *Protea Atlas Newsletter* 40. Protea Atlas Project, Kirstenbosch.

REBELO, A.G. & REBELO, P. (eds). 1999a. *Interim distribution maps. Peninsula edn* 4. Protea Atlas Project, Kirstenbosch.

REBELO, A.G. & REBELO, P. (eds). 1999b. *Protea Atlas Newsletter* 41. Protea Atlas Project, Kirstenbosch.

REBELO, A.G. & REBELO, P. (eds). 1999c. *Protea Atlas Newsletter* 42. Protea Atlas Project, Kirstenbosch.

RETIEF, E. 1998. Succulents of the coastal dunes and estuaries of southern Africa—an overview. *Aloe* 35: 49–54.

RETIEF, E. & VAN WYK, A.E. 1998. The genus *Echium* (Boraginaceae) in southern Africa. *Bothalia* 28: 167–177.

ROFF, J. 1998. The muthi garden project. *Roots* 16: 27, 28.

ROHDE, R., COUSINS, B. & HOFFMAN, M.T. 1999. Experiments in expanding the commons—comparisons from Namibia and South Africa. *Proceedings of the International Symposium 'Property rights, risks and livestock development', Feldafing, Germany, 27 September–1 October 1998*.

ROURKE, J.P. 1998. A review of the systematics and phylogeny of the African Proteaceae. *Australian Systematic Botany* 11: 267–285.

ROUX, J.P. 1998. Pteridophyta. In T. Trinder-Smith, *A guide to the flora of the South Western Cape*: 14–20. Bolus Herbarium, University of Cape Town.

RUNDEL, P.W., ESLER, K.J. & MIDGLEY, G.F. 1998. The ecophysiological significance of Mesembryanthemaceae growth forms and demography. *Aloe* 35: 35–37.

RUTHERFORD, M.C., POWRIE, L.W. & SCHULZE, R.E. 1998. Climate change in conserved areas of South Africa and its potential impact on vegetation. In *The Earth's changing land.*

GCTE-LUCC Open Science Conference on Global Change. Abstracts. IGBP and IHDP, Spain.
SCHUTTE, A. & VAN WYK, B-E. 1998. The tribal position of *Hypocalyptus* Thunberg (Fabaceae). *Novon* 8: 178–182.
SCHUTTE-VLOK, A. 1998. Not all milk and honeybush tea. *Veld & Flora* 84: 90, 91.
SCOTT-SHAW, R., HILTON-TAYLOR, C., KASSEEPURSAD, B. & CHURCH, B. 1998. The conservation status of the Pepper Bark Tree. *SABONET News* 3: 73–75.
SMITH, G.F. 1998a. A further note on succulence. *British Cactus and Succulent Journal* 16: 211–213.
SMITH, G.F. 1998b. New editor for *Bothalia*. *Bothalia* 28: 113–115.
SMITH, G.F. 1998c. Species plantarum: Flora of the world. Can southern African systematists contribute? *SABONET News* 3: 29–31.
SMITH, G.F. 1998d. Geographical distribution of Piperaceae in southern Africa. *SABONET News* 3: 75, 76.
SMITH, G.F. 1998e. Distribution of Piperaceae in southern Africa: how much do we really know? *SABONET News* 3: 164, 165.
SMITH, G.F. 1998f. Message from the new President of the IOS. *IOS Bulletin* 6: 4, 5.
SMITH, G.F. 1998g. Mesembs of the world. Illustrated guide to a remarkable succulent plant group. *IOS Bulletin* 6: 30, 31.
SMITH, G.F. 1998h. The International Organization for Succulent Plant Study and its 25th Congress: *Aloe* 35: 30.
SMITH, G.F. 1998i. Vygies. Fantasieplante in 'n droë paradys. *Custos* (September): 20, 21.
SMITH, G.F., BREDENKAMP, G.J. & VAN STADEN, J. 1998. New editorial dispensation. *South African Journal of Botany* 64: 369, 370.
SMITH, G.F., CHESSELET, P., VAN JAARSVELD, E.J., HARTMANN, H.E.K., HAMMER, S.A., VAN WYK, B.-E., BURGOYNE, P.M., KLAK, C. & KURZWEIL, H. 1998. *Mesembs of the World*. Briza Publications, Pretoria.
SMITH, G.F. & GERMISHUIZEN, G. 1998. Progress with the trial phase for registration of new plant names. *SABONET News* 3: 168–171.
SMITH, G.F. & GERMISHUIZEN, G. 1999. Progress with the trial phase for registration of new plant names. *South African Journal of Botany* 65: 112–114.
SMITH, G.F. & STEYN, E.M.A. 1998. Obituary: Barend Petrus Barkhuizen (1921–1995): amateur botanist, succulent plant specialist and educator. *Bothalia* 28: 243–245.
SMITH, G.F., STEYN, E.M.A., VAN WYK, A.E. & CONDY, G. 1999. *Gasteria baylissiana*. *Curtis's Botanical Magazine* 16: 24–28.
SMITH, G.F. & VAN WYK, B-E. 1998a. Aalwyne so eg Suid-Afrikaans soos ... mieliepap! *Aloe* (July): 23–25.
SMITH, G.F. & VAN WYK, B-E. 1998b. Asphodelaceae. In K. Kubitzki, *The families and genera of vascular plants*. 3: 130–140. Springer-Verlag, Berlin.
SMITH, G.F. & VAN WYK, B-E. 1998c. Indigenous plants, rugged beauties. *South African Gardening* (May): 32–34.
SMITH, G.F. & WILLIS, C.K. 1998. Systematic biologists of South Africa: united we stand ... at last. *South African Journal of Science* 94: 519, 520.
SMITH, G.F., WILLIS, C. & MÖSSMER, M. 1998. Progress with updating the *Index herbariorum*: southern African supplement. *SABONET News* 3: 166–168.
SMITH, G.F., WILLIS, C.K. & VAN WYK, B-E. 1998. Systematic biologists of South Africa, unite! *South African Journal of Science* 94: 107, 108.
SMITH, M.T., FIELD, C.R., CROUCH, N.R. & HIRST, M. 1998. The distribution of mesembrine alkaloids in selected taxa of the Mesembryanthemaceae and their modification in the *Sceletium* derived 'kougoed'. *Pharmaceutical Biology* 36: 173–179.
SNIJMAN, D.A. & WILLIAMSON, G.A. 1998. A new species of *Amaryllis* from the Richtersveld, South Africa (Amaryllidaceae: Amaryllideae). *Bothalia* 28: 192–196.
STEINER, K.E. 1998. The evolution of beetle pollination in a South African orchid. *American Journal of Botany* 85: 1180–1193.
STEYN, E.M.A. 1998. Kei beacon tree. *Tree of the Year 1998*. Department of Water Affairs & Forestry, Pretoria.
STEYN, E.M.A. & SMITH, G.F. 1998a. Ovule orientation, curvature and internal structure in the Aloaceae. *South African Journal of Botany* 64: 192–197.
STEYN, E.M.A., SMITH, G.F., NILSSON, S. & GRAFSTRÖM, E. 1998. Pollen morphology in *Aloe* L. (Aloaceae). *Grana* 37: 23–27.
SWARTZ, P. 1998. Madagascar—the red island; bleeding into the sea. *British Cactus and Succulent Journal* 16: 159–163.
TODD, S.W. & HOFFMAN, M.T. 1998a. Communal rangelands in semi-arid South Africa. *Veld & Flora* 84: 82.
TODD, S.W. & HOFFMAN, M.T. 1998b. Fenced in and nowhere to go. *Veld & Flora* 84: 84, 85.
TODD, S.W., SEYMOUR, C., JOUBERT, D.F. & HOFFMAN, M.T. 1998. Communal rangelands and biodiversity: insights from Paulshoek, Namaqualand. In T.D. de Bruyn & P.F. Scogings, Communal rangeland in southern Africa: a synthesis of knowledge. *Proceedings of the symposium 'Policy-making for the sustainable use of southern African communal rangelands', University of Fort Hare, 6–9 July 1998*: 177–189.
VAN DER WALT, L. 1998. A waterwise garden at Kirstenbosch. *Veld & Flora* 84: 48, 49.
VAN JAARSVELD, E. 1998a. *Dactylopsis littlewoodi* L.Bolus. *Aloe*: 24.
VAN JAARSVELD, E. 1998b. *Displosoma retrocersum* (Kensit) Schwantes. *Aloe* 35: 23.
VAN JAARSVELD, E. 1998c. Indigenous house plants. Herbaceous plants. *Veld & Flora* 84: 130–132.
VAN JAARSVELD, E. 1998d. Indigenous house plants. Large accents plants. *Veld & Flora* 84: 96, 97.
VAN JAARSVELD, E. 1998e. *Tylecodon peculiarus* (Crassulaceae), a new species from the northern Knersvlakte region (Western Cape). *Aloe* 35: 10, 11.
VAN JAARSVELD, E. 1998f. Veld gardening in South Africa: the highveld garden. *Veld & Flora* 84: 17–21.
VAN JAARSVELD, E. 1998g. Veld gardening in South Africa: the karoo garden. *Veld & Flora* 84: 59–63.
VAN ROOY, J. 1998. Introduction to bryology in southern Africa. 4. The structure and life cycle of liverworts and hornworts. *PlantLife* 19: 29–31.
VAN ROOY, J. 1999. Introduction to bryology in southern Africa. 5. How to study bryophytes. *PlantLife* 20: 34–36.
VICTOR, J.E. & NICHOLAS, A. 1998. In defence of *Tenaris* and *Macropetalum* (Asclepiadaceae). *South African Journal of Botany* 64: 205–208.
VICTOR, J.E. & VAN WYK, A.E. 1998. Palynology of *Acmadenia* (Diosminae: Rutaceae) and its taxonomic implications. *Grana* 37: 143–154.
WARNER, B. & ROURKE, J.P. 1998. *Flora Herscheliana. Sir John and Lady Herschel at the Cape, 1834–1838*. Brenthurst Press, Johannesburg.
WELMAN, W.G. 1998a. Review: Wild flowers of northern South Africa, by A. Fabian & G. Germishuizen. 1997. *Dendron* 33: 27, 28.
WELMAN, W.G. 1998b. Review: Making the most of indigenous trees, by F. Venter & J.A. Venter. 1996. *Dendron* 33: 28.
WELMAN, W.G. & MEEUSE, A.D.J. 1998. Revised key to *Ipomoea* (Convolvulaceae) in southern Africa. *Bothalia* 28: 19–24.
WILLIAMS, R. Regional news update: news from Natal Herbarium. *SABONET News* 3: 190, 191.
WILLIS, C.K. (ed.). 1998a. *SABONET News* 3,1: 1–52.
WILLIS, C.K. (ed.). 1998b. *SABONET News* 3,2: 53–116.
WILLIS, C.K. 1998c. Aquatic plants course in Moremi. *SABONET News* 3: 58–62.
WILLIS, C.K. 1998d. Herbaria, plant taxonomists and environmental impact assessments. *SAIE&ES Fast Track News* 2: 5, 6.
WILLIS, C.K., BOTHA, D. & WINTER, J. 1998. A needs assessment of southern African botanical gardens. *SABONET News* 3: 140–144.
WILLIS, C.K. & MÖSSMER, M. (eds). 1998. *SABONET News* 3,3: 117–195.
WILLIS, C.K. & SMITH, G.F. 1998. Expanding and updating *Index herbariorum*: southern African supplement. *SABONET News* 3: 79, 80.
WOLFSON, M. Material exchange agreement. *SABONET News* 3: 136–138.
WYN JONES, R.G., YOUNG, E.M., HOFFMAN, M.T., MAGOLE, L., PETERSEN, A., ARNTZEN, J., & MAJORO, M. 1998. Global change and subsistence rangelands in southern Africa: an outline of a European Union funded project. In T.D. de Bruyn & P.F. Scogings, Communal rangeland in southern Africa: a synthesis of knowledge. *Proceedings of the symposium 'Policy-making for the sustainable use of southern African communal rangelands', University of Fort Hare, 6–9 July 1998*: 30–37.

Bothalia 29,2: 357–365 (1999)

Guide for authors to *Bothalia*

This guide is updated when necessary and includes an index. **Important points and latest additions appear in bold type**.

Bothalia is named in honour of General Louis Botha, first Premier and Minister of Agriculture of the Union of South Africa. This house journal of the National Botanical Institute, Pretoria, is devoted to the furtherance of botanical science. The main fields covered are taxonomy, ecology, anatomy and cytology. Two parts of the journal and an index to contents, authors and subjects are published annually.

1 Editorial policy

1.1 *Bothalia* welcomes original papers dealing with flora and vegetation of southern Africa and related subjects. Full-length papers and short notes, as well as book reviews and obituaries of botanists, are accepted. **The editor should be notified that an article is part of a series of MSS; please submit a list of the parts of a series; all parts should preferably be published in one journal.**

1.2 **Page charges**: As stated in our notification included in volume 23,1 (May 1993), MSS submitted for publication in *Bothalia* are subject to payment of page charges of R125,00 per printed page, VAT included. The following are exempt from these charges: 1, NBI members; 2, persons/institutions who have been granted exemption by the Executive Committee of the NBI; 3, authors of contributions requested by the Editor; 4, contributors to the column '*FSA* contributions'. The Editor's decision on the number of pages is final. An invoice will be sent to the author, who must arrange for payment as soon as possible to NBI, Publications Section, Private Bag X101, Pretoria 0001.

1.3 Articles are assessed by referees, both local and overseas. Authors are welcome to suggest possible referees to judge their work. Authors are responsible for the factual correctness of their contributions. *Bothalia* maintains an editorial board (see title page) to ensure that international standards are upheld.

2 Requirements for a manuscript

2.1 The original manuscript should be typed on one side of A4-size paper, double-spaced throughout (including abstract, tables, captions to figures, literature references, etc.) and have a margin of at least 30 mm all round. **Three** photocopies (**all pages photocopied on both sides** of the paper, **including figures**, to reduce weight for postage) of all items, including text, line drawings, tables and lists should be submitted, and the author should retain a complete set of copies. **Three photographs (or high quality photocopies) of each photograph/photograph mosaic should be submitted for review purposes.** If the article was generated on a computer, a copy of the diskette should be submitted with the final (accepted) version (see 3).

2.2 Papers should conform to the general style and layout of recent issues of *Bothalia* (from volume 26 onwards).

2.3 Material should be presented in the following sequence: Title page with title, name(s) of author(s), keywords, abstract (and information that should be placed in a footnote on the title page, such as address(es) of author(s) and mention of granting agencies.

2.4 The sequence continues with Introduction and aims, Contents (see 8), Material and methods, Results, Interpretation (Discussion), Specimens examined (in revisions and monographs), Acknowledgements, References, Index of names (recommended for revisions dealing with more than about 15 species), Tables, Captions for figures and figures. In the case of short notes, obituaries and book reviews, keywords and abstract are superfluous.

2.5 **All pages must be numbered** consecutively beginning with the title page to those with references, tables, captions for figures and figures.

2.6 For notes on the use of hyphens and dashes see 3.10 to 3.12.

2.7 Special character: use your own word or code that is unique and self-explanatory, enclosed between ANGLE BRACKETS, e.g. <mu>m for µm. Please supply us with a list of the codes.

3 Requirements for diskettes/stiffies
(to be submitted only with final/accepted version)

3.1 data must be IBM compatible and written in **ASCII, or in Word for Windows 95 from Windows 1; Word for MS-DOS from MSWord 3; WordPerfect 5 for DOS only; Windows Write 3 onwards**; **rtf file retains the formatting**.

3.2 the original printout of the diskette should be supplied in **double line** spacing.

3.3 tables need not be placed on the diskette—a clearly laid out hard copy is adequate.

3.4 use a **non-breaking space** to keep two elements together on the same line, e.g. 3 500.

3.5 DO NOT JUSTIFY LINES.

3.6 do not break words, except hyphenated words.

3.7 all lines, headings, keys, etc., should start flush at the margin, therefore NO INDENTATIONS, FOOTNOTES, TABS OR STYLES of any kind.

3.8 in **Word and WordPerfect**, italics and bold should be used where necessary.

3.9 paragraphs and headings are delineated by a carriage return (ENTER) but **no indentation**.

3.10 a hyphen is designated as one dash, with no space between the letter and the dash, e.g. ovate-lanceolate. See also 17.6.

3.11 an N-dash is typed as **three** hyphens with no space between the letter and the hyphen, e.g. 2- - -5 mm (typeset, it looks like this, 2–5 mm).

3.12 an M-dash is typed as **two** hyphens with no space between the letter and the hyphen, e.g. computers- -what a blessing! (typeset, it looks like this: computers—what).

3.13 do not use a double space between words, after commas, full stops, colons, semicolons or exclamation marks.

3.14 use lower case x as times sign, with one space on either side of the x, e.g. 2 x 3 mm.

3.15 use **single** (**not double**) opening and closing quotes, e.g. the so-called 'stiffy' refers to a rigid diskette.

3.16 keys—put only three leader dots before number of taxon (with one space before and one space after the first and last dot), regardless of how far or near the word is from the right margin, e.g. ... 1. *R. ovata* (see 13.18).

4 Author(s)

When there are several authors the covering letter should indicate clearly which of them is responsible for correspondence and, if possible, telephonically available while the article is being processed. The contact address and telephone number should be mentioned if they differ from those given on the letterhead.

5 Title

The title should be as concise and as informative as possible. In articles dealing with taxonomy or closely related subjects the family of the taxon under discussion (see also 13.2) should be mentioned in brackets but **author citations should be omitted from plant names** (see also 13.6).

6 Keywords

Up to 10 keywords (or index terms) should be provided in English in **alphabetical sequence**. The following points should be borne in mind when selecting keywords:

6.1 keywords should be unambiguous, internationally acceptable words and not recently coined little-known words.

6.2 they should be in a noun form and verbs should be avoided.

6.3 they should not consist of an adjective alone; adjectives should be combined with nouns.

6.4 they should not contain prepositions.

6.5 the singular form should be used for processes and properties, e.g. evaporation.

6.6 the plural form should be used for physical objects, e.g. augers.

6.7 **location** (province and/or country); taxa (species, genus, family) and vegetation type (community, veld type, biome) should be used as keywords.

6.8 keywords should be selected hierarchically where possible, e.g. both family and species should be included.

6.9 they should include terms used in the title.

6.10 they should answer the following questions:

6.10.1 what is the *active concept* in the document (activity, operation or process).

6.10.2 what is the *passive concept* or object of the active process (item on which the activity, operation or process takes place).

6.10.3 what is the means of accomplishment or how is the active concept achieved (technique, method, apparatus, operation or process).

6.10.4 what is the environment in which the active concept takes place (medium, location).

6.10.5 what are the independent (controlled) and dependent variables?

6.11 questions 6.10.1 to 6.10.3 should preferably also be answered in the title.

7 Abstract

7.1 Abstracts of no more than 200 words should be provided. Abstracts are of great importance and should convey the essence of the article.

7.2 They should refer to the geographical area concerned and, in taxonomic articles, mention the number of taxa treated. They should not contain information not appearing in the article.

7.3 In articles dealing with taxonomy or closely related subjects all taxa from the rank of genus downwards should be accompanied by their author citations (see also 13.6).

7.4 **Names of new taxa and new combinations should not be italicized but put in bold**. If the article deals with too many taxa, only the important ones should be mentioned.

8 Table of contents

A table of contents should be given for all articles longer than about 40 typed pages, unless they follow the strict format of a taxonomic revision.

9 Acknowledgements

Acknowledgements should be kept to the minimum compatible with the requirements of courtesy. Please give all the initials of the person(s) you are thanking.

10 Literature references

In text

10.1 Literature references in the text should be cited as follows: 'Jones & Smith (1986) stated...', or '...(Jones & Smith 1986)' or (Ellis 1988: 67) when giving a reference simply as authority for a statement. For treatment of literature references in taxonomic papers see 14.

10.2 When **more than two authors** are involved in the paper, use the name of the first author followed by *et al.*

10.3 When referring to more than one literature reference, they should be arranged **chronologically** and separated by a semicolon, e.g. (Nixon 1940; Davis 1976; Anon. 1981, 1984).

10.4 Titles of books and names of journals should preferably not be mentioned in the text. If there is good reason for doing so, they should be treated as described in 10.12 & 10.13.

10.5 Personal communications are given only in the text, not in the list of references. Please add the person's full initials to identify the person more positively, e.g. C. Boucher pers. comm.

In References at end of article

10.6 References of the same author are arranged in chronological sequence.

10.7 Where two or more references by the same author are listed in succession, the author's name is repeated with every reference, except in an obituary, where the name of the deceased in the list of publications (not in the references) is replaced by an N-dash.

10.8 All publications referred to in the text, including those mentioned in full in the treatment of correct names in taxonomic papers, but no others, and no personal communications, are listed at the end of the manuscript under the heading References.

10.9 The references are arranged alphabetically according to authors and chronologically under each author, with a, b, c, etc. added to the year, if the author has published more than one work in a year. **This sequence is retained when used in the text, irrespective of the chronology**.

10.10 If an author has published both on his own and as a senior author with others, the solo publications are listed first and after that, in strict alphabetical sequence, those published with one or more other authors.

10.11 Author names are typed in capitals.

10.12 Titles of journals and of books are written out in full and are italicized as follows: *Transactions of the Linnean Society of London* 5: 171–217, or *Biology and ecology of weeds*: 24.

10.13 Titles of books should be given as in *Taxonomic literature*, edn 2 by Stafleu & Cowan and names of journals as in the latest edition of *World list of scientific periodicals*.

10.14 Examples of references:

Collective book or Flora

BROWN, N.E. 1909. Asclepiadaceae. In W.T. Thiselton-Dyer, *Flora capensis* 6,2: 518–1036. Reeve, London.

CUNNINGHAM, A.B. 1994. Combining skills: participatory approaches in biodiversity conservation. In B.J. Huntley, Botanical diversity in southern Africa. *Strelitzia* 1: 149–167. National Botanical Institute, Pretoria.

Book

DU TOIT, A.L. 1966. *Geology of South Africa*, 3rd edn, S.M. Haughton (ed.). Oliver & Boyd, London.

HUTCHINSON, J. 1946. *A botanist in southern Africa*. Gawthorn, London.

Journal

DAVIS, G. 1988. Description of a proteoid-restioid stand in Mesic Mountain Fynbos of the southwestern Cape and some aspects of its ecology. *Bothalia* 18: 279–287.

SMOOK, L. & GIBBS RUSSELL, G.E. 1985. Poaceae. *Memoirs of the Botanical Survey of South Africa* No. 51: 45–70.

STEBBINS, G.L. Jr 1952. Aridity as a stimulus to plant evolution. *American Naturalist* 86: 35–44.

In press, in preparation

TAYLOR, H.C. in press. *A reconnaissance of the vegetation of Rooiberg State Forest*. Technical Bulletin, Department of Forestry.

VOGEL, J.C. 1982. *The age of the the Kuiseb river silt terrace at Homeb. Palaeoecology of Africa* 15. In press.

WEISSER, P.J., GARLAND, J.F. & DREWS, B.K. in prep. Dune advancement 1937–1977 and preliminary vegetation succession chronology at Mlalazi Nature Reserve, Natal, South Africa. *Bothalia*.

Thesis

KRUGER, F.J. 1974. *The physiography and plant communities of the Jakkalsrivier Catchment*. M.Sc. (Forestry) thesis, University of Stellenbosch.

MUNDAY, J. 1980. *The genus* Monechma *Hochst. (Acanthaceae tribe Justiciae) in southern Africa*. M.Sc. thesis, University of the Witwatersrand, Johannesburg.

Miscellaneous paper, report, unpublished article, technical note, congress proceedings

ANON. no date. *Eetbare plante van die Wolkberg*. Botanical Research Unit, Grahamstown. Unpublished.

BAWDEN, M.G. & CARROL, D.M. 1968. *The land resources of Lesotho*. Land Resources Study No. 3, Land Resources Division, Directorate of Overseas Surveys, Tolworth.

BOUCHER, C. 1981. Contributions of the Botanical Research Institute. In A.E.F. Heydorn, *Proceedings of workshop research in Cape estuaries*: 105–107. National Research Institute for Oceanology, CSIR, Stellenbosch.

NATIONAL BUILDING RESEARCH INSTITUTE 1959. *Report of the committee on the protection of building timbers in South Africa against termites, woodboring beetles and fungi*, 2nd edn. CSIR Research Report No. 169.

11 Tables

11.1 Each table should be presented on a separate sheet and be assigned an Arabic numeral, i.e. the first table mentioned in the text is marked 'Table 1'.

11.2 In the captions of tables the word 'TABLE' is written in capital letters. See recent numbers of *Bothalia* for the format required.

11.3 Avoid vertical lines, if at all possible. Tables can often be reduced in width by interchanging primary horizontal and vertical heads.

12 Figures

12.1 Figures should be planned to fit, after reduction, into a width of either 80, 118 or 165 mm, with a maximum vertical length of 230 mm. Allow space for the caption in the case of figures that will occupy a whole page.

12.2 Line drawings, including graphs and diagrams, should be twice the size of the final reproduction and should be in jet-black Indian ink, preferably on fine Felix Schoeller parole or similar paper, 200 gsm, or tracing film. Lines should be bold enough **and letters/symbols large enough** to stand reduction.

12.3 Photographs should be of excellent quality on glossy paper with clear detail and moderate contrast, and they should be the same size as required in the journal.

12.4 Photograph mosaics should be submitted complete, the component photographs mounted neatly on a white **flexible card base (can be curved around drum of scanner)** leaving a narrow gap of uniform width (2 mm) between each print. Note that grouping photo-

graphs of markedly divergent contrast results in poor reproductions.

12.5 Lettering and numbering on all figures should be done in letraset, stencilling or a comparable method. If symbols are to be placed on a dark background it is recommended that black symbols are used on a small white disk ± 7 mm in diameter and placed in the **lower left hand corner** of the relevant photo.

12.6 If several illustrations are treated as components of a single composite figure they should be designated by **capital letters**.

12.7 Note that the word 'Figure' should be written out in full, both in the text and the captions and should begin with a capital 'F' (**but see 14.7 for taxonomic papers**).

12.8 In the text the figure reference is then written as in the following example: 'The stamens (Figure 4A, B, C) are...'

12.9 In captions, 'FIGURE' is written in capital letters. Magnification of figures should be given for the size as submitted.

12.10 **Scale bars or scale lines should be used on figures**.

12.11 In figures accompanying taxonomic papers, voucher specimens should be given in the relevant caption.

12.12 Figures are numbered consecutively with Arabic numerals **in the order they are referred to in the text**. These numbers, as well as the author's name and an indication of the top of the figure, must be written in soft pencil on the back of all figures.

12.13 Captions of figures must **not** be pasted under the photograph or drawing.

12.14 Authors should indicate **in pencil** in the text where they would like the figures to appear.

12.15 Authors wishing to have the originals of figures returned must inform the editor in the original covering letter and must mark each original 'To be returned to author'.

12.16 Authors wishing to use illustrations already published must obtain written permission before submitting the manuscript and inform the editor of this fact.

12.17 Captions for figures should be collected together and typed **at the end of the MS** and headed *Captions for figures*.

12.18 It is strongly recommended that taxonomic articles include dot maps as figures to show the distribution of taxa. The dots used must be large enough to stand reduction to 80 mm (recommended size: letraset 5 mm diameter). **No open diamonds or open triangles should be used.**

12.19 Blank distribution maps of southern Africa, Africa and the world are available from the Bookshop, NBI Pretoria.

13 Text

13.1 As a rule, authors should use the names (but not of all authors of plant names—see 13.6) as listed by T.H. Arnold & B.C. de Wet (eds) in *Memoirs of the Botanical Survey of South Africa* No. 62.

13.2 Names of genera and infrageneric taxa are usually italicized, with the author citation (where relevant; see 13.6) not italicized. Exceptions include names of new taxa in the abstract, correct names given in the synopsis or in paragraphs on species excluded from a given supraspecific group in taxonomic articles; in checklists and in indices, where the position is reversed, correct names are not italicized and synonyms are italicized.

13.3 Names above generic level are not italicized.

13.4 In articles dealing with taxonomy, the complete scientific name of a plant (with author citation) should be given at the first mention in the text. The generic name should be abbreviated to the initial thereafter, except where intervening references to other genera with the same initial could cause confusion (see 16.6).

13.5 **In normal text, Latin words are italicized, but in the synopsis of a species, Latin words such as *nom. nud.* and *et al.* are not italicized** (see 14.3, 16.4, 17.9).

13.6 In accordance with Garnock-Jones & Webb (1996) in *Taxon* 45: 285, 286, authors of plant names are not to be added to plant names except in taxonomic papers. Names of authors of plant names should agree with the list published by the Royal Botanic Gardens, Kew, entitled, *Authors of plant names*, edited by R.K. Brummitt & C.E. Powell (1992).

13.7 Modern authors not included in the list should use their full name and initials when publishing new plant names. Other author names not in the list should be in agreement with the recommendations of the Code.

13.8 Names of authors of publications are written out in full except in the synonymy in taxonomic articles where they are treated like names of authors of plant names.

13.9 Names of plant collectors are italicized whenever they are linked to the number of a specimen. The collection number is also italicized, e.g. *Acocks 14407*.

13.10 Surnames beginning with 'De', 'Du' or 'Van' begin with a capital letter unless preceded by an initial.

13.11 For measurements use only units of the International System of Units (SI). **In taxonomic papers only mm and m, should be used; in ecological papers cm or m should be used.**

13.12 The use of '±' is preferred to c. or ca (see 17.7).

13.13 Numbers 'one' to 'nine' are spelled out in normal text, and from 10 onwards they are written in Arabic numerals.

13.14 In descriptions of plants, numerals are used throughout. Write 2.0–4.5 (not 2–4.5). When counting members write 2 or 3 (not 2–3), but 2–4.

13.15 Abbreviations should be used sparingly but consistently. No full stops are placed after abbreviations ending with the last letter of the full word (e.g. edition = edn; editor = ed.); after units of measure; after compass directions; after herbarium designations; **after countries, e.g. USA and after well-known institutions, e.g. CSIR**.

13.16 Apart from multi-access keys, indented keys should be used with couplets numbered 1a–1b, 2a–2b, etc. (without full stops thereafter).

13.17 Keys consisting of a single couplet have no numbering.

13.18 Manuscripts of keys should be presented as in the following example:

1a Leaves closely arranged on an elongated stem; a submerged aquatic with only the capitula exserted ... 1b. *E. setaceum* var. *pumilum*

1b Leaves in basal rosettes; stems suppressed; small marsh plants, ruderals or rarely aquatics:

2a Annuals, small, fast-growing pioneers, dying when the habitat dries up; capitula without coarse white setae; receptacles cylindrical:

3a Anthers white ... 2. *E. cinereum*

3b Anthers black ... 3. *E. nigrum*

2b Perennials, more robust plants; capitula sparsely to densely covered with short setae:

13.19 Herbarium voucher specimens should be referred to wherever possible, not only in taxonomic articles.

14 Species treatment in taxonomic papers

14.1 The procedure to be followed is illustrated in the example (17.9), which should be referred to, because not all steps are described in full detail.

14.2 The correct name (bold, not italicized) is to be followed by its author citation (italicized) and the full literature reference, with the name of the publication written out in full (not italicized).

14.3 Thereafter all literature references, including those of the synonyms, should only reflect author, page and year of publication, e.g. C.E. Hubb. in Kew Bulletin 15: 307 (1960); Boris et al.: 14 (1966); Boris: 89 (1967); Sims: t. 38 (1977); Sims: 67 (1980).

14.4 The description and the discussion should consist of paragraphs commencing, where possible, with italicized leader words such as *flowering time, etymology, diagnostic characters, distribution* and *habitat*.

14.5 When more than one species of a given genus is dealt with in a paper, the correct name of each species should be prefixed by a sequential number followed by a full stop. Infraspecific taxa are marked with small letters, e.g. 1b., 12c., etc.

14.6 Names of authors are written as in 13.6, irrespective of whether the person in question is cited as the author of a plant name or of a publication.

14.7 The word 'figure' is written as 'fig.', and 't.' is used for both 'plate' and 'tablet' (but see 12.7 for normal text).

14.8 Literature references providing good illustrations of the species in question may be cited in a paragraph commencing with the word **Illustrations** followed by a colon. This paragraph is given after the last paragraph of the synonymy, see 17.9.

14.9 When new combinations are made, the full literature reference must be given for the basionym, e.g.:

Antimima saturata *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia saturata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 122 (1929). *Mesembryanthemum atrocinctum* N.E.Br.: 32 (1930). Type: *Pillans BOL18952* (BOL, holo.!).

15 Citation of specimens

15.1 Type specimen in synopsis: the following should be given (if available): country (if not in RSA), province, grid reference (at least for new taxa), locality as given by original collector, modern equivalent of collecting locality in square brackets (if relevant, e.g. Port Natal [now Durban]), **quarter-degree square**, date of collection (optional), collector's name and collecting number (both italicized).

15.2 The abbreviation *s.n.* (*sine numero*) is given after the name of a collector who usually assigned numbers to his collections but did not do so in the specimen in question. The herbaria in which the relevant type(s) are housed are indicated by means of the abbreviations given in the latest edition of *Index Herbariorum*.

15.3 The holotype (holo.) and its location are mentioned first, followed by a semicolon, the other herbaria are arranged alphabetically, separated by commas.

15.4 Authors should indicate by means of an exclamation mark (!) which of the types have been personally examined.

15.5 If only a photograph or microfiche was seen, write as follows: *Anon. 422* (X, holo.–BOL, photo.!).

15.6 Lectotypes or neotypes should be chosen for correct names without a holotype. It is not necessary to lectotypify synonyms.

15.7 When a lectotype or a neotype are newly chosen, this should be indicated by using the phrase 'here designated' (see 17.9). If reference is made to a previously selected lectotype or neotype, the name of the designating author and the literature reference should be given. In cases where no type was cited, and none has subsequently been nominated, this may be stated as 'not designated'.

15.8 In brief papers mentioning only a few species and a few cited specimens the specimens should be arranged according to the grid reference system: Provinces/countries (typed in capitals) should be cited in the following order: Namibia, Botswana, Northern Province (previously Northern Transvaal), North-West (previously northeastern Cape and southwestern Transvaal), Gauteng (previously PWV), Mpumalanga (previously Eastern Transvaal), Free State (previously Orange Free State), Swaziland, KwaZulu-Natal (previously Natal), Lesotho, and Northern Cape, Western Cape and Eastern Cape (Figure 1).

15.9 Grid references should be cited in numerical sequence.

15.10 Locality records for specimens should preferably be given to within a quarter-degree square. Records from the same one-degree square are given in alphabetical order, i.e (–AC) precedes (–AD), etc. Records from the same quarter-degree square are arranged alphabetically according to the collectors' names; the quarter-degree references must be repeated for each specimen cited.

15.11 The relevant international code of the herbaria in which a collection was seen should be given in brackets after the collection number; the codes are separated by commas. The following example will explain the procedure:

KWAZULU-NATAL.—2731 (Louwsburg): 16 km E of Nongoma, (–DD), *Pelser 354* (BM, K, PRE); near Dwarsrand, *Van der Merwe 4789* (BOL, M). 2829 (Harrismith): near Groothoek, (–AB), *Smith 234*; Koffiefontein, (–AB), *Taylor 720* (PRE); Cathedral Peak Forest Station, (–CC), *Marriot 74* (KMG); Wilgerfontein, *Roux 426*. Grid ref. unknown: Sterkstroom, *Strydom 12* (NBG).

15.12 For records from outside southern Africa authors should use degree squares without names, e.g.:

KENYA.—0136: Nairobi plains beyond race course, *Napier 485*.

15.13 Monographs and revisions: in the case of all major works of this nature it is assumed that the author has investigated the relevant material in all major herbaria and that he has provided the specimens seen with determinavit labels. It is assumed further that the author has submitted distribution maps for all relevant taxa and that the distribution has been described briefly in words in the text. Under the heading 'Vouchers' no more than five specimens should be cited, indicating merely the collector and the collector's number (both italicized). Specimens are alphabetically arranged according to collector's name. If more than one specimen by the same collector is cited, they are arranged numerically and separated by a comma. The purpose of the cited specimens is not to indicate distribution but to convey the author's concept of the taxon in question.

15.14 The herbaria in which the specimens are housed are indicated by means of the abbreviation given in the latest edition of *Index Herbariorum*. They are given between brackets, arranged alphabetically and separated by commas behind every specimen as in the following example:

Vouchers: *Arnold 64* (PRE); *Fisher 840* (NH, NU, PRE); *Flanagan 831* (GRA, PRE), *840* (NH, PRE); *Marloth 4926* (PRE, STE); *Schelpe 6161, 6163, 6405* (BOL); *Schlechter 4451* (BM, BOL, GRA, K, PRE).

15.15 If long lists of specimens are given, they must be listed together before Acknowledgements under the heading *Specimens examined*. They are arranged alphabetically by the collector's name and then numerically for each collector. The species is indicated in brackets by the number that was assigned to it in the text and any infraspecific taxa by a small letter. If more than one genus is dealt with in a given article, the first species of the first genus mentioned is indicated as 1.1. This is followed by the international herbarium designation. Note that the name of the collector and the collection number are italicized:

Acocks 12497 (2.1b) BM, K, PRE; *14724* (1.13a) BOL, K, P. *Archer 1507* (1.4) BM, *G. Burchell 2847* (2.8c) MB, K. *Burman 2401* (3.3) MO, S. B.L. *Burtt 789* (2.6) B, KMG, STE.

16 Synonyms

16.1 In a monograph or a revision covering all of southern Africa, all synonyms based on types of southern African origin, or used in southern African literature, should be included.

16.2 Illegitimate names are designated by *nom. illeg.* after the reference, followed by *non* with the author and date, if there is an earlier homonym.

16.3 Nomina nuda (*nom. nud.*) and invalidly published names are excluded unless there is a special reason to cite them, for example if they have been used in prominent publications.

16.4 In normal text Latin words are italicized, but in the synopsis of a species Latin words such as *nom. nud.*, *et al.* are not italicized (see 13.5, 14.3, 17.9).

16.5 Synonyms should be arranged chronologically into groups of nomenclatural synonyms, i.e. synonyms based on the same type, and the groups should be arranged chronologically by basionyms, except for the basionym of the correct name which is dealt with in the paragraph directly after that of the correct name.

16.6 When a generic name is repeated in a given synonymy it should be abbreviated to the initial, except where intervening references to other genera with the same initial could cause confusion (see 13.4).

17 Description and example of species treatment

17.1 Descriptions of all taxa of higher plants should, where possible, follow the sequence: Habit; sexuality; underground parts (if relevant). *Indumentum* (if it can be easily described for the whole plant). *Stems/branches. Bark. Leaves*: arrangement, petiole absent/present, pubescence; blade: shape, size, apex, base, margin; midrib: above/below, texture, colour; petiole; stipules. *Inflorescence*: type, shape, position; bracts/bracteoles, **involucral bracts: inner, outer**. *Flowers*: shape, sex. *Receptacle. Calyx. Corolla. Disc. Androecium. Gynoecium. Fruit. Seeds. Chromosome number* (reference). *Conservation status*. Figure (word written out in full) number.

17.2 As a rule, shape should be given before measurements.

17.3 In general, if an organ has more than one of the parts being described, use the plural, otherwise use the singular, for example, petals of a flower but blade of a leaf.

17.4 Language must be as concise as possible, using participles instead of verbs.

17.5 Dimension ranges should be cited as in 17.9.

17.6 Care must be exercised in the use of dashes and hyphens. A *hyphen* is a short stroke joining two syllables of a word, e.g. ovate-lanceolate or sea-green, with no space between the letter and the stroke. An *N-dash* (*en*) is a longer stroke commonly used instead of the word 'to' between numerals, '2–5 mm long' (do not use it between words but rather use the word 'to', e.g. 'ovate to lanceolate'; it is produced by typing **three** hyphens next to each other. An *M-dash* (*em*) is a stroke longer than an N-dash and is used variously, e.g. in front of a subspecific epithet instead of the full species name; it is produced by typing **two** hyphens next to one another.

17.7 The use of '±' is preferred to c. or ca when describing shape, measurements, dimensions, etc. (see 13.12).

17.8 **The decimal point replaces the comma in all units of measurement**, e.g. leaves 1.0–1.5 mm long.

17.9 Example:

1. **Englerophytum magalismontanum** *(Sond.) T.D.Penn.* The genera of Sapotaceae: 252 (1991). Type: Gauteng, Magaliesberg, *Zeyher 1849* (S, holo.–BOL, photo.!).

Bequaertiodendron magalismontanum (Sond.) Heine & Hemsl.: 307 (1960); Codd: 72 (1964); Elsdon: 75 (1980).

Chrysophyllum magalismontanum Sond.: 721 (1850); Harv.: 812 (1867); Engl.: 434 (1904); Bottmar: 34 (1919). *Zeyherella magalismontana* (Sond.) Aubrév. & Pellegr.: 105 (1958); Justin: 97 (1973).

Chrysophyllum argyrophyllum Hiern: 721 (1850); Engl.: 43 (1904). *Boivinella argyrophylla* (Hiern) Aubrév. & Pellegr.: 37 (1958); Justin et al.: 98 (1973). Types: Angola, *Welwitsch 4828* (BM!, lecto., here designated; PRE!); Angola, *Welwitsch 4872* (BM!).

Chrysophyllum wilmsii Engl.: 4, t. 16 (1904); Masonet: 77 (1923); Woodson: 244 (1937). *Boivinella wilmsii* (Engl.) Aubrév. & Pellegr.: 39 (1958); Justin: 99 (1973). Type: Mpumalanga, Magoebaskloof, *Wilms 1812* [B, holo.†; K!, P!, lecto., designated by Aubrév. & Pellegr.: 38 (1958), PRE!, S!, W!, Z!].

Bequaertiodendron fruticosa De Wild.: 37 (1923), non Bonpl.: 590 (1823); D.Bakker: 167 (1929); H.Fr.: 302 (1938); Davy: 640 (1954); Breytenbach: 117 (1959); Clausen: 720 (1968); Palmer: 34 (1969). Type: Mpumalanga, Tzaneen Dist., *Granville 3665* (K, holo.!; G!, P!, PRE!, S!).

B. fragrans auct. non Oldemann: Glover: 149, t. 19 (1915); Henkel: 226 (1934); Stapelton: 6 (1954).

Illustrations: Harv.: 812 (1867); Henkel: t. 84 (1934?); Codd: 73 (1964); Palmer: 35 (1969).

Woody perennial; main branches up to 0.4 m long, erect or decumbent, grey woolly-felted, leafy. *Leaves* linear to oblanceolate, 3–10(–23) × 1.0–1.5(–4.0) mm, obtuse, base broad, half-clasping. *Heads* heterogamous, campanulate, 7–8 × 5 mm, solitary, sessile at tip of axillary shoots; involucral bracts in 5 or 6 series, inner exceeding flowers, tips subopaque, white, very acute. *Receptacle* nearly smooth. *Flowers* ± 23–30, 7–11 male, 16–21 bisexual, yellow, tipped pink. *Achenes* ± 0.75 mm long, elliptic. *Pappus* bristles very many, equalling corolla, scabridulous. *Chromosome number*: 2n = 22. Figure 23B.

18 New taxa

18.1 The name of a new taxon must be accompanied by at least a Latin diagnosis. Authors should not provide full-length Latin descriptions unless they have the required expertise in Latin at their disposal.

18.2 It is recommended that descriptions of new taxa be accompanied by a good illustration (line drawing or photograph) and a distribution map.

18.3 Example:

109. **Helichrysum jubilatum** *Hilliard*, sp. nov. *H. alsinoidei* DC. affinis, sed foliis ellipticis (nec spatulatis), inflorescentiis compositis a foliis non circumcinctis, floribus femineis numero quasi dimidium hermaphroditorum aequantibus (nec capitulis homogamis vel floribus femineis 1–3 tantum) distinguitur.

Herba annua e basi ramosa; caules erecti vel decumbentes, 100–250 mm longi, tenuiter albo-lanati, remote foliati. *Folia* plerumque 8–30 × 5–15 mm, sub capitulis minora, elliptica vel oblanceolata, obtusa vel acuta, mucronata, basi semi-amplexicauli, utrinque cano-lanato-arachnoidea. *Capitula* heterogama, campanulata, 3.5–4.0 × 2.5 mm, pro parte maxima in paniculas cymosas terminales aggregata; capitula subterminalia interdum solitaria vel 2 vel 3 ad apices ramulorum nudorum ad 30 mm longorum. *Bracteae involucrales* 5-seriatae, gradatae, exteriores pellucidae, pallide stramineae, dorso lanatae, seriebus duabus interioribus subaequalibus et flores quasi aequantibus, apicibus obtusis opacis niveis vix radiantibus. *Receptaculum* fere laeve. *Flores* ± 35–41. *Achenia* 0.75 mm longa, pilis myxogenis praedita. *Pappi* setae multae, corollam aequantes, apicibus scabridis, basibus non cohaerentibus.

TYPE.—Northern Cape, 2817 (Vioolsdrif): Richtersveld, (–CC), ± 5 miles E of Lekkersing on road to Stinkfontein, kloof in hill south of road, annual, disc whitish, 7-11-1962, *Nordenstam 1823* (S, holo.; E, NH, PRE).

19 New provinces of South Africa (Oct. 1996)

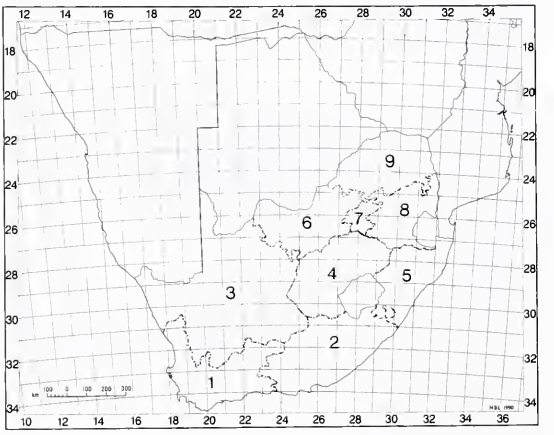

FIGURE 1.—1, Western Cape; 2, Eastern Cape; 3, Northern Cape; 4, Free State (previously Orange Free State); 5, KwaZulu-Natal (previously Natal); 6, North-West (previously northeastern Cape and southwestern Transvaal); 7, Gauteng (previously PWV); 8, Mpumalanga (previously Eastern Transvaal); 9, Northern Province (previously Northern Transvaal).

20 Proofs

Only page proofs are normally sent to authors. They should be corrected in red ink and be returned to the editor **as soon as possible**. Do not add any new information.

21 Reprints

Authors receive 100 reprints free. If there is more than one author, this number will have to be shared between them.

22 Documents consulted

Guides to authors of the following publications were made use of in the compilation of the present guide: *Annals of the Missouri Botanic Garden, Botanical Journal of the Linnean Society, Flora of Australia, Smithsonian Contributions to Botany, South African Journal of Botany* (including instructions to authors of taxonomic papers), *South African Journal of Science*.

23 Address of editor

Manuscripts should be submitted to: The Editor, Bothalia, National Botanical Institute, Private Bag X101, Pretoria 0001.

24 *FSA* contributions

24.1 Figures and text must conform to *Bothalia* format.

24.2 These articles will be considered as a full contribution to the *Flora of southern Africa* and will be listed as published in the '*Plan of Flora of southern Africa*', which appears in all issues of the *FSA* series.

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Acknowledgements to referees 1983–1999

B.A. MOMBERG and O.A. LEISTNER

With this list we express our sincere thanks to the many, hitherto unacknowledged referees of papers published in this journal since the Pretoria AETFAT Congress in 1982.

Akeroyd, Dr J., England, Polygonaceae
Almborn, Dr O.† 1992, Sweden, Asteraceae
Anderberg, Dr A., Sweden, Asteraceae
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